# INSTALLATION ASSESSMENT
# OF
# ROCK ISLAND ARSENAL
## REPORT NO. 164
## DECEMBER 1979



US ARMY

TOXIC AND HAZARDOUS MATERIALS AGENCY

ABERDEEN PROVING GROUND, MARYLAND 21010

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INSTALLATION ASSESSMENT

OF

ROCK ISLAND ARSENAL

RECORDS EVALUATION REPORT NO. 164

Concur with findings and recommendations based on information developed by US Army Toxic and Hazardous Materials Agency.

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# ABSTRACT

A records search was conducted at Rock Island Arsenal to assess the environmental quality with regard to the use, storage, treatment, and disposal of toxic and hazardous materials and to define any conditions which may adversely affect health and welfare or result in environmental degradation.

The review of records identified the old landfills and industrial waste storage sites as the major contaminated areas. Major contaminants include: heavy metals (lead, zinc, and chromium), cyanide salts, petroleum-oil-lubricants, and organic solvents.

Data on water from onpost supply and monitoring wells indicate that there is no migration of contaminants to the initial groundwater or in the initial aquifer below bedrock.

A preliminary survey is not recommended.

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I. GENERAL

A. Purpose of the Assessment

To assess the environmental quality of the Rock Island Arsenal (RIA) with regard to the use, storage, treatment, and disposal of toxic and hazardous materials and to define any conditions which may adversely affect health and welfare or result in environmental degradation.

B. Authority

DARCOM Regulation 10-30, Mission and Major Functions of the US Army Toxic and Hazardous Materials Agency (USATHAMA), 22 May 1979.

C. Introduction

1. In response to a letter from the Commander, USATHAMA, requesting the identification of potentially contaminated installations, the Commander, US Army Armament Materiel Readiness Command (ARRCOM), recommended that RIA be included in the Installation Restoration Program.

2. Presurvey instructions were forwarded on 5 February 1979 to outline assessment scope, provide guidelines, and obtain advance information for review by the Records Search Team prior to the onsite search.

3. RIA personnel were briefed on 16 April 1979 by a USATHAMA representative on the Installation Restoration Program prior to the onsite records search.

4. Various government agencies were contacted from 1 January to 30 April 1979 for documents pertinent to the records evaluation assessment. Agencies contacted included:

a. Department of Defense Explosives Safety Board (DDESB).
b. US Army Environmental Hygiene Agency (USAEHA).
c. US Geological Survey (USGS).
d. US Army Engineer Waterways Experiment Station (WES).
e. US Army Armament Materiel Readiness Command (ARRCOM).
f. Chemical Systems Laboratory (CSL).

5. The onsite phase of the records review was conducted from 16 to 20 April 1979. The following personnel were assigned to the team and prepared the report:

a. Mr. Reed Magness, Team Leader (CSL).
b. Mr. Robert Grula, Chemist (CSL).
c. Mr. Daniel Wenz, Chemical Engineer (CSL).
d. Mr. Roy Yon, Ordnance Specialist (CSL).
e. SP4 Dennis Hall, Environmentalist (CSL).
f. Mr. Jack Lewis, Geologist (WES).

6. In addition to the review of the records, interviews were conducted with former and present employees. A ground tour of the installation was made; photographs taken during the tour are included in Appendix A.

7. The findings are based on the records made available at the time of the search. Where conspicuous discrepancies existed, attempts were made to determine the correct information by interviewing personnel (if available) involved in preparing the original data.

D. Installation History

RIA is located on an island in the Mississippi River between Iowa and Illinois (Figure 1). Upon recommendation of the Secretary of War, Rock Island was approved by Congress as a western armory on 11 July 1862. The 384 hectares (ha) of Rock Island are divided as follows: Rock Island Arsenal, 367 ha; US Army Corps of Engineers, 4 ha; National Cemetery, 11 ha; and the Confederate Cemetery, 1 ha. The 367 ha under the control of RIA are divided into three management land uses: improved land, 80 ha; semi-improved land, 61 ha; and the remaining unimproved land encompasses 226 ha which also includes 68 ha outleased for a golf course.

Missions of the arsenal included the manufacture of small arms during the Spanish-American War and again from 1899 to 1917. Between 1918 and 1941, RIA was utilized as a storage and repair facility for ordnance materiel. During this period RIA specialized in tank and armored vehicle development. During World War II, the design and manufacture of ordnance materiel increased tremendously. RIA assembled heavy guns, made heavy gun carriages, manufactured small arms, gun mounts, and recoil mechanisms and did tank repair and modification. Since World War II, depot and manufacturing operations have declined except for limited periods during the Korean and Vietnam Conflicts. The present mission of RIA is to perform manufacturing of assigned materiel and its required direct support to include engineering and product assurance. Assigned materiel includes aircraft weapons, infantry weapons, air defense weapons, gun mounts, recoil mechanisms and carriages for tanks and artillery, armaments for tanks, special tools, tool sets and common tools and maintenance equipment. Prototype and advanced engineering models are manufactured in support of US Army Armament Research & Development Command (ARRADCOM). RIA provides the Armed Forces with manufacturing and support services not readily available from private industry.

E. Environmental Setting

1. Meteorological Data

The climate of the area is moist and sub-humid with a wide temperature range throughout the year. Winters are typically cold with many days of sub-freezing temperatures. Summers are mild with periodic high temperatures and high humidity. The first and last average frost dates are 15 October and 19 April, respectively.

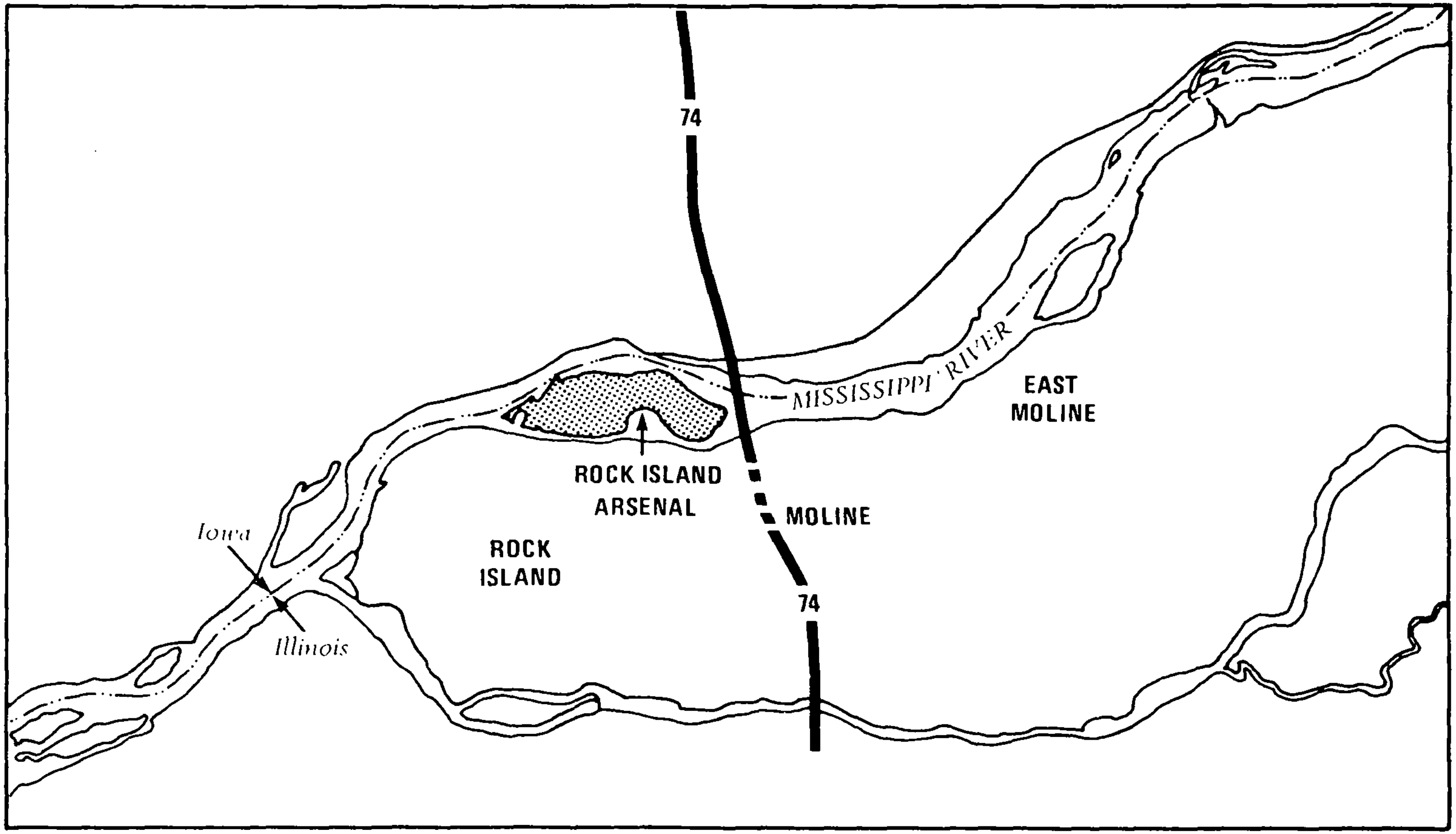



Figure 1. Site Map

The greatest amount of precipitation occurs between mid-April and mid-October. The mean annual snowfall is 67.5 centimeters (cm). See Table I for climatological data.

2. Biota

The limited unimproved acreage of RIA precludes the development of an extensive wildlife program. However, a few animal species are found on the installation. These include squirrels, rabbits, and raccoons, as well as a variety of birds (ducks and geese). The locality provides excellent food and shelter for migratory waterfowl.

The region encompassing RIA is considered a possible habitat for the following protected species: the Illinois mud turtle, the American bald eagle, and the plains hognose snake. Two mussel species are presently found in the Sylvan Slough south of the installation: the spectacle case (*Cumberlandia monodonta*) and Higgins eye (*Lampsilis higginsii*).

Principle native flora found on the installation are listed in Appendix B. The American elm (*Ulmarea americana*), presently considered an endangered species, is found in the vicinity of RIA.

3. Geology

a. Physiography/Topography

RIA lies on the extreme western edge of the Till Plains Section of the Central Lowland Physiographic Province in western Illinois. The bedrock in this section has been considerably modified by Pleistocene glaciation and its associated meltwater runoff. As a result, a very irregular bedrock surface covered with a thin veneer of alluvium, loess, and glacial drift is present. There is also the possibility that glacial channels filled with glacial deposits exist in the upper bedrock strata.

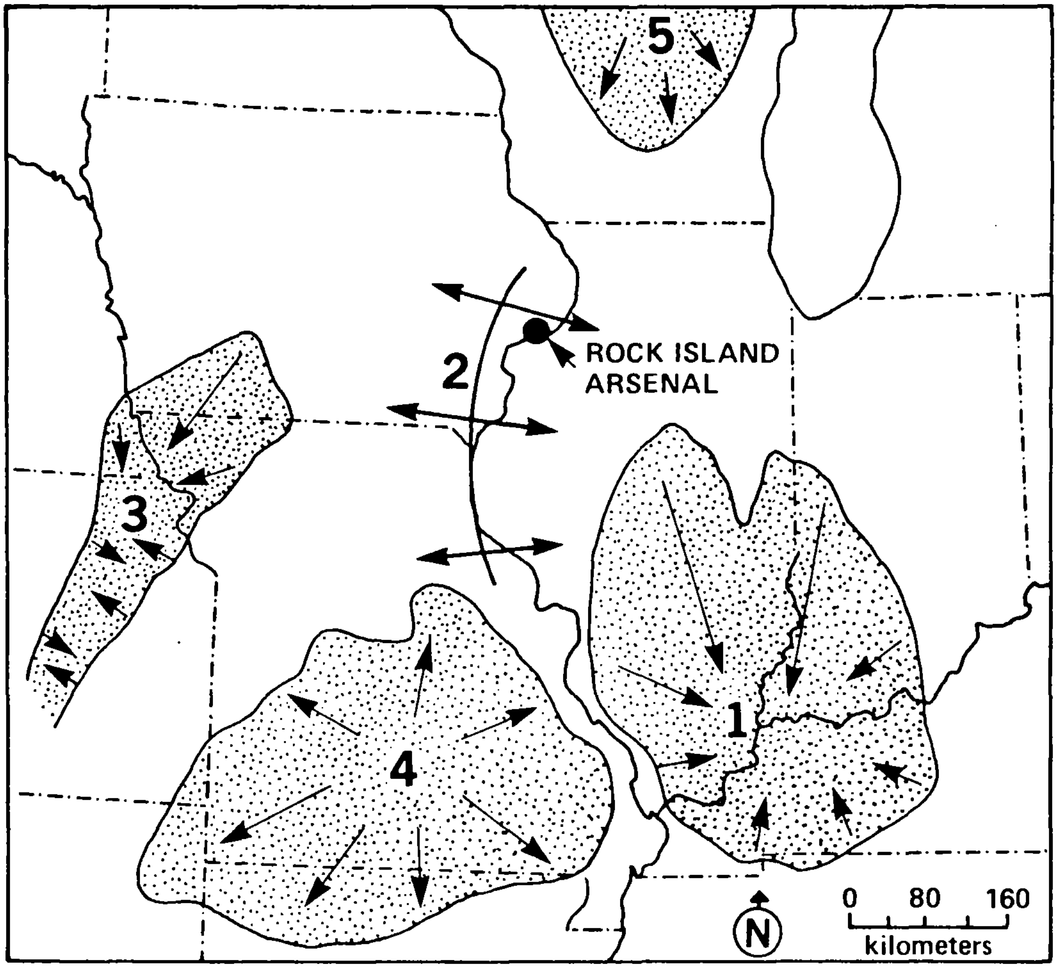
A very gently rolling terrain characterizes the topography at RIA. Surface elevations range from a low of 168 meters (m) above mean sea level (msl) at the edge of Sylvan Slough to a high of 181 m at Building 390 near the center of the island. Water levels of the Mississippi River on the north side of RIA and water in the Moline Pool (Water Power Pool) behind the Arsenal Power Dam are 171 m above msl.

RIA is located just east of the axis of the north to south trending Mississippi River Arch as shown in Figure 2. The Mississippi River Arch is a low, broad, gentle upwarp of bedrock strata that separates the Illinois Basin from the Forest City Basin in Iowa. The regional dip of bedrock strata at RIA is gently to the east and southeast, with the slope approximating a 0.61 m vertical drop per 30.4 m of horizontal distance. Figures 3 and 4 show the regional geologic map and generalized cross section of the area, respectively.

TABLE I

TEN YEAR AVERAGE
ANNUAL TEMPERATURES AND PRECIPITATION

| MONTH | AVERAGE TEMPERATURE (°C) | AVERAGE PRECIPITATION (cm) |
|---|---|---|
| January | -5.26 | 4.03 |
| February | -3.53 | 3.38 |
| March | 1.90 | 5.98 |
| April | 10.00 | 7.93 |
| May | 16.35 | 9.50 |
| June | 22.06 | 10.88 |
| July | 24.42 | 8.15 |
| August | 23.30 | 8.83 |
| September | 18.65 | 8.13 |
| October | 12.77 | 6.15 |
| November | 4.03 | 4.88 |
| December | -2.86 | 4.13 |
| Average Monthly Temperature | 10.14 | |
| Total Annual Precipitation | | 81.98 |
| Extreme Annual High | 44.24 | 124.03 |
| Extreme Annual Low | -32.48 | 43.33 |




Locations of (1) the Illinois Basin, (2) the Mississippi River Arch, (3) the Forest City Basin, (4) the Ozark Dome, and (5) the Wisconsin Arch. (Arrows point down slope on the structures.)

Figure 2. Mississippi River Arch

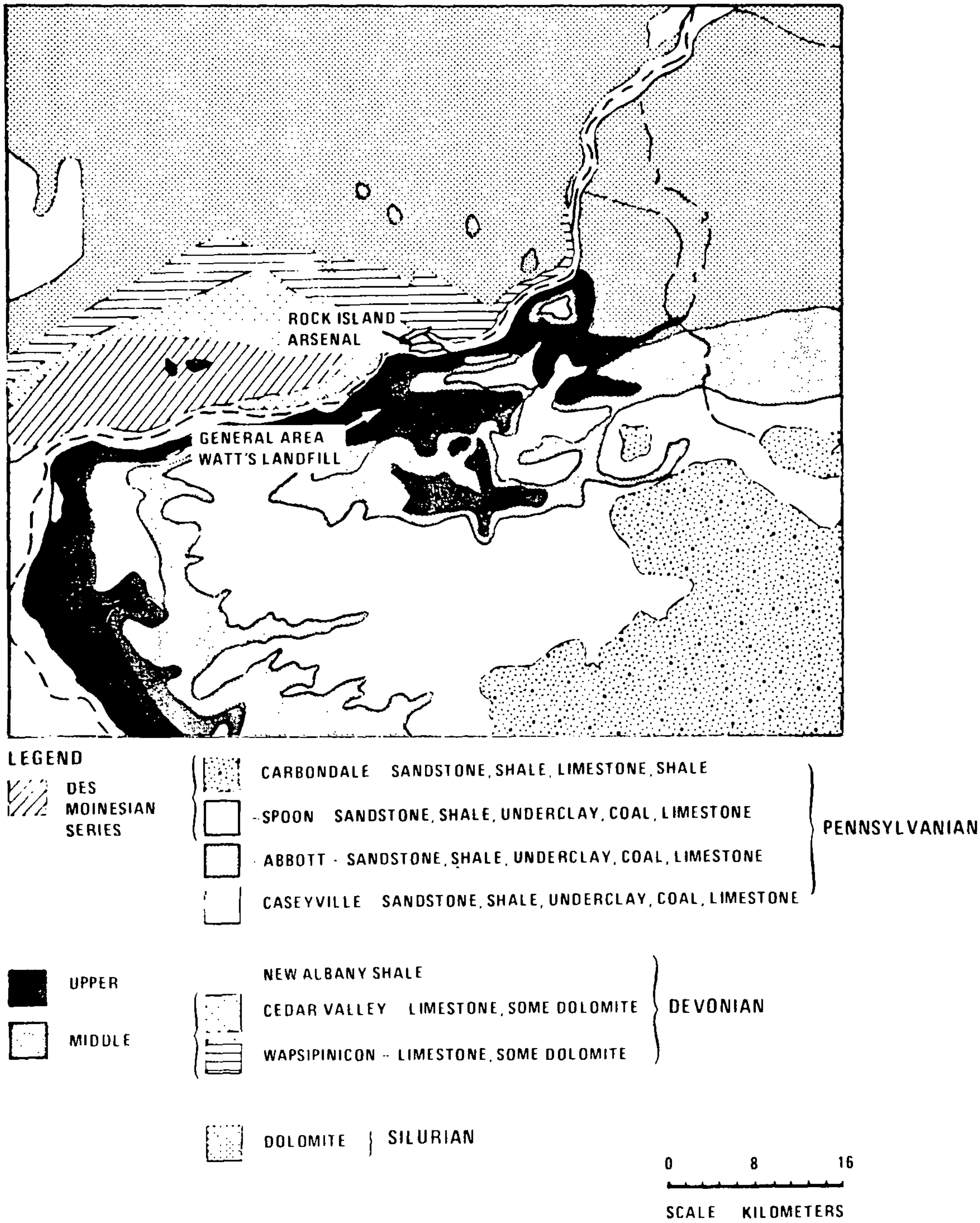



Figure 3. Generalized Geologic Map

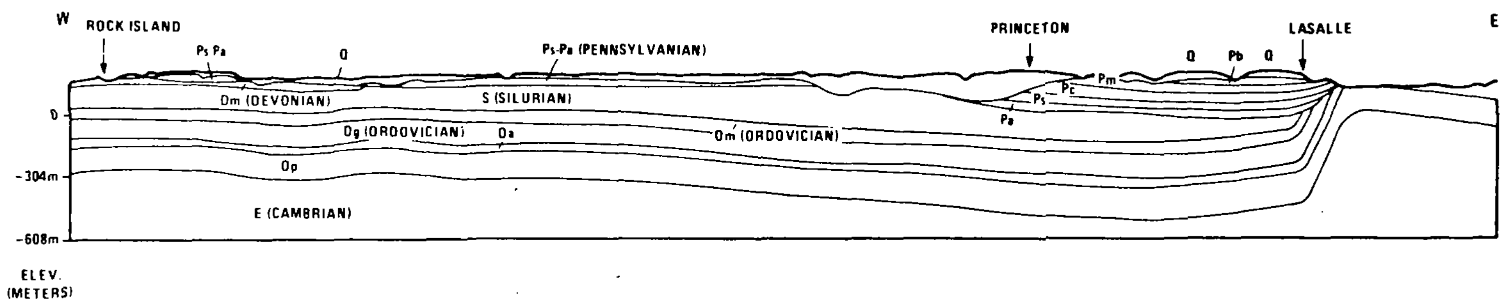



Figure 4. East-West Cross-Section: Rock Island to LaSalle

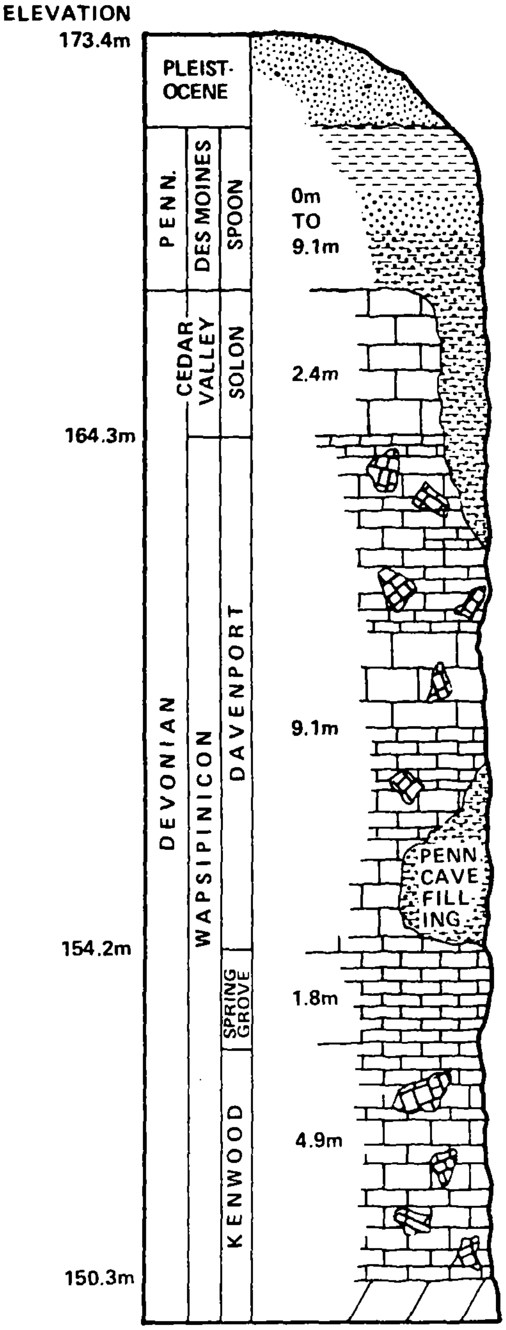
Geologic formations expected to be encountered with depth beneath the veneer of unconsolidated soils range in age from Pennsylvanian to Precambrian. However, intervening beds of Mississippian age which once covered Devonian limestone in the area were eroded prior to deposition of Pennsylvanian strata. Consequently, some thin surface exposures of Pennsylvanian beds may also be present lying directly on the eroded Devonian bedrock surface. For the most part, the top of bedrock at RIA is the Davenport Limestone Member of the Wapsipinicon formation of Devonian age. Here a brecciated, fractured, vuggy limestone surface of the Wapsipinicon formation lies directly beneath most of the glacial drift and alluvium overburden at RIA. This limestone surface was subjected to considerable weathering and erosion, resulting in the formation of some solution channels and cavernous conditions. In some borings drilling water was lost upon encountering the bedrock surface. Figure 5 is a stratigraphic section of a stone quarry located in the vicinity of Rock Island. A more generalized stratigraphic column of the area is shown in Figure 6.

b. Surface Waters

Surface drainage of RIA is primarily via open ditches into catch basins and then through storm drain lines to outfalls located around the perimeter of the island. Generally, a surface drainage from all of the buildings located west of East Avenue, between the golf course on the north and Rodman Avenue on the south, is through storm drain pipes. This drainage empties into the Mississippi River and includes runoff from the Overhaul and Assembly Shops (Building 208) located on the south side of Rodman Avenue. Drainage from a warehouse (Building 344) and the entire golf course along the north side of the arsenal passes through storm drain outfalls into the Mississippi River. The area encompassing the test tracks and Confederate Cemetery drains south into the Moline Pool. The Small Arms Simulator, National Cemetery Area, and the Gymnasticator Building drain into the 45.8 cm cast-iron drain pipe and through an outfall into Sylvan Slough Canal. The remaining areas, primarily those located south of Rodman Avenue and west of the Power Dam, drain southward through storm drains to eight outfalls spaced along the Sylvan Slough shoreline. Areas south of the warehouses (Buildings 170-199), the sanitary landfill south of Building 299, the old landfill area near the Sewage Pump House (Building 204), and open storage areas located along the southern boundary generally drain southward along the surface slope into Sylvan Slough.

Groundwater is encountered in the soil overlying bedrock at several locations on the island. Depths to the top of groundwater range from one to five meters. Indications are that the groundwater in the unconsolidated material occurs in discontinuous lenticular layers of silt and sand.

Allied Stone Company Quarry - Stratigraphic Section
SE1/4, Sec. 14, T. 17 N., R. 2 W.
Rock Island County, Illinois




Loess and very thin glacial drift.

Shale, black to dark gray, fissile to blocky with interbedded thin sandstones. Grades down to greenish-gray, sandy shales and light colored pyritic sandstones.

Limestone, buff, fine- to medium-grained, numerous brachiopods.

Limestone, very light gray, sublithographic to lithographic, very brecciated, green clay and shale streaks, graded downward to greenish gray and light brownish gray limestone, hard and brittle, numerous wavy bands, and irregular thin beds.

Cave fillings common with fine to medium angular sand interbedded with greenish clay and shale. Fragments of plants and much pyrite are common.

Limestone, very light gray to very light buff, dolomitic, lithographic to sublithographic, stylolitic, weathers to thin slabs, some breccia.

Limestone, brownish to bluish-gray and dark colored, fine to coarsely crystalline with thin dark shale laminae, brecciated with shale and limestone matrix.

Dolomite, brownish-gray, fine-grained.

Figure 5. Stratigraphic Section of a Stone Quarry Located in the Rock Island Vicinity

| SYS. | SERIES | GROUP, STAGE | FORMATION | THICKNESS (meters) | GENERAL DESCRIPTION | |
|---|---|---|---|---|---|---|
| QUATERNARY | | Holocene | | | Soil alluvium | |
| QUATERNARY | Pleistocene | Wisconsinan | | 0-18.3 | Loess, silts, outwash | U |
| QUATERNARY | Pleistocene | Illinoian-Kansan | | 0-45.6 | Till, outwash | U |
| PENNSYLVANIAN | | | Spoon | | Sandstone, shale, underclay, coal, and limestone | |
| PENNSYLVANIAN | | | Abbott<br>Caseyville | 0-28.9 | | U |
| DEVONIAN | U. | New Albany | | 0-0.9 | Shale | |
| DEVONIAN | Mid. | | Cedar Valley<br>Wapsipinicon | 42.6 | Limestone; some dolomite | U |
| SILURIAN | Niag. | | Racine<br>Marcus<br>Sweeney | 65.4-<br>114.1 | Dolomite, vuggy | |
| SILURIAN | Alex. | | Blanding<br>Tete des Morts<br>Mosalem | | Dolomite, partly cherty | U |
| ORDOVICIAN | Cinc. | Maquoketa | Brainard<br>Ft. Atkinson<br>Scales | 57.8-<br>66.9 | Shale; some dolomite | U |
| ORDOVICIAN | Champlainian | Galena-Platteville | Wise Lake<br>Dunleith<br>Guttenberg | 91.3-<br>106.5 | Dolomite; some limestone, cherty | |
| ORDOVICIAN | Champlainian | Ancell | Glenwood<br>St. Peter | 15.2<br>50.2 | Sandstone; a little dolomite and shale near top | U |
| ORDOVICIAN | Canadian | Prairie du Chien | Shakopee<br>New Richmond<br>Oneota<br>Gunter | 136.9 | Dolomite, cherty; sandstone | |
| CAMBRIAN | Croixan | | Eminence<br>Potosi<br>Franconia<br>Ironton-Galesville<br>Eau Claire<br>Mt. Simon | 638.8 | Sandstone; shale, dolomite | U |
| PRECAMBRIAN | | | | | Granite | |

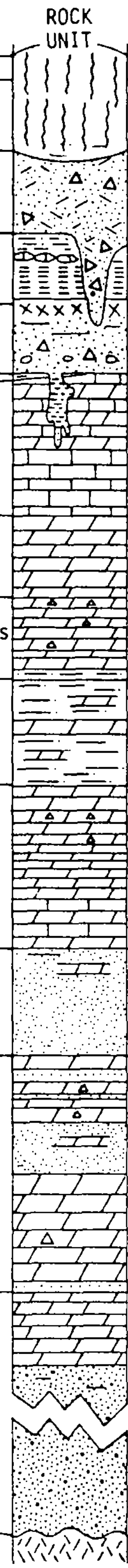



Fig. 6 - Generalized geologic column of strata underlying the Milan area. "U" indicates a major unconformity. (Not to scale.)

Non-responsive

[redacted]

LEGEND: FIGURES 7a, b. SOIL SURVEY MAP

| | |
|---|---|
| 83 | WABASH |
| W83 | WABASH SILTY CLAY, WET |
| 155D | PLATTVILLE SILT LOAM, REDDISH SUBSOIL VARIANT, 0 TO 4% SLOPES |
| 304 | LANDES FINE SANDY LOAM |
| 314A | JOLIET SILTY CLAY LOAM, 0 TO 4% SLOPES |
| 317A | MILLSDALE SILTY CLAY LOAM, 0 TO 4% SLOPES |
| 415 | ORION SILT LOAM |
| 440A | JASPER LOAM, 0 TO 2% SLOPES |
| W455 | MIXED ALLUVIAL LAND, WET |
| 485 | MONTGOMERY SILTY CLAY |
| 740 | LOAM |
| 749B | LOAM, 2 TO 4% SLOPES |
| 757C2 | LOAMY SAND, 4 TO 12% SLOPES, ERODED |
| 759B | LOAMY SAND, 0 TO 4% SLOPES |
| 750C2 | LOAMY SAND, 4 TO 12% SLOPES, ERODED |
| 764A | LOAMY SAND, 0 TO 4% SLOPES |
| 764C | LOAMY SAND, 4 TO12% SLOPES |
| 765A | SILT LOAM, 0 TO 4% SLOPES |
| 961B | STOCKLAND-CARMI COMPLEX, 2 TO 6% SLOPES |
| V314A | JOILET SILTY CLAY LOAM, SUBSOIL VARIANT, 0 TO 4% SLOPES |

NOTE: INFORMATION FOR THIS MAP WAS COMPILED BY THE DEPARTMENT OF AGRICULTURE IN APRIL 1970.

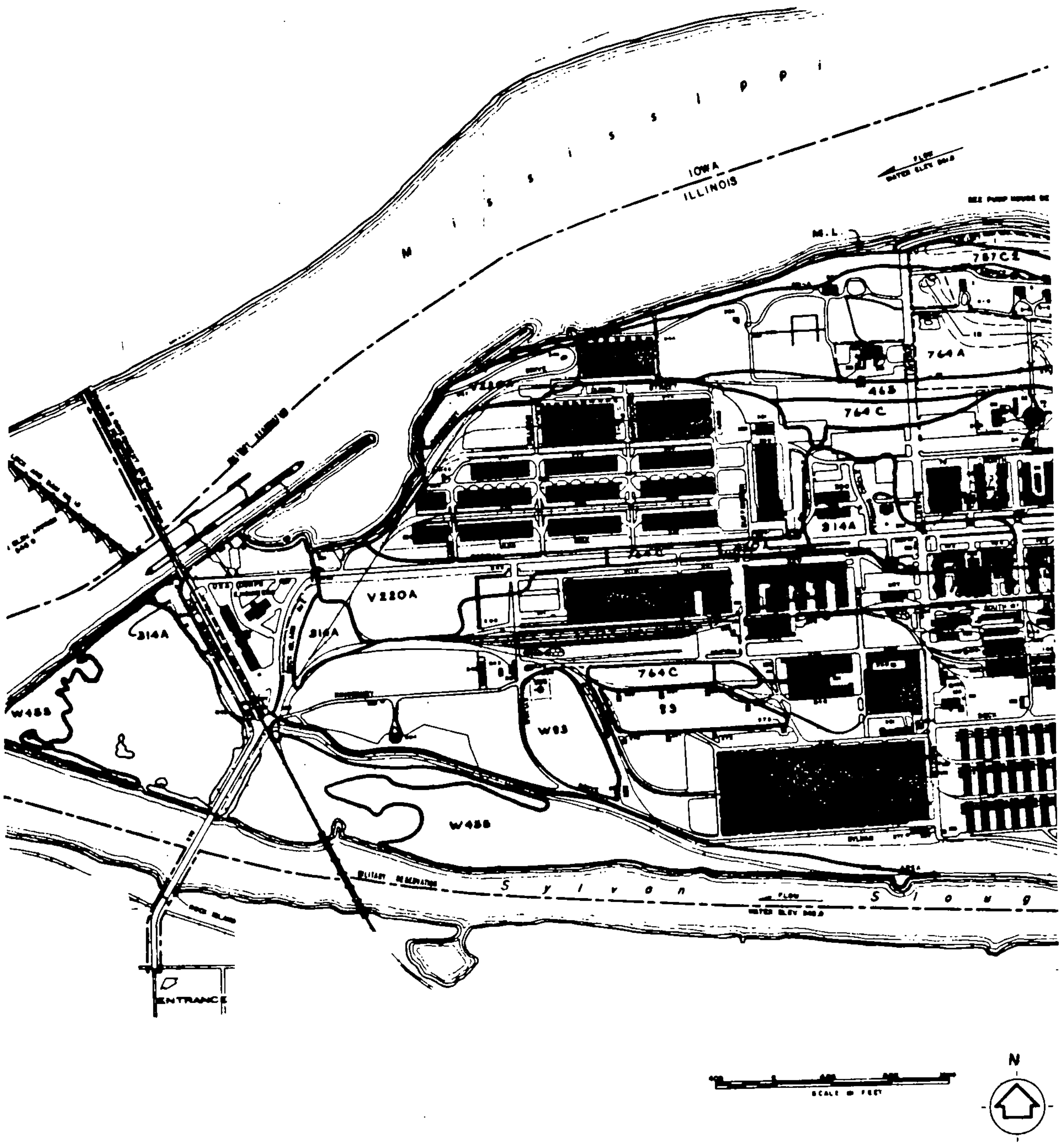



Figure 7a. Soil Survey Map

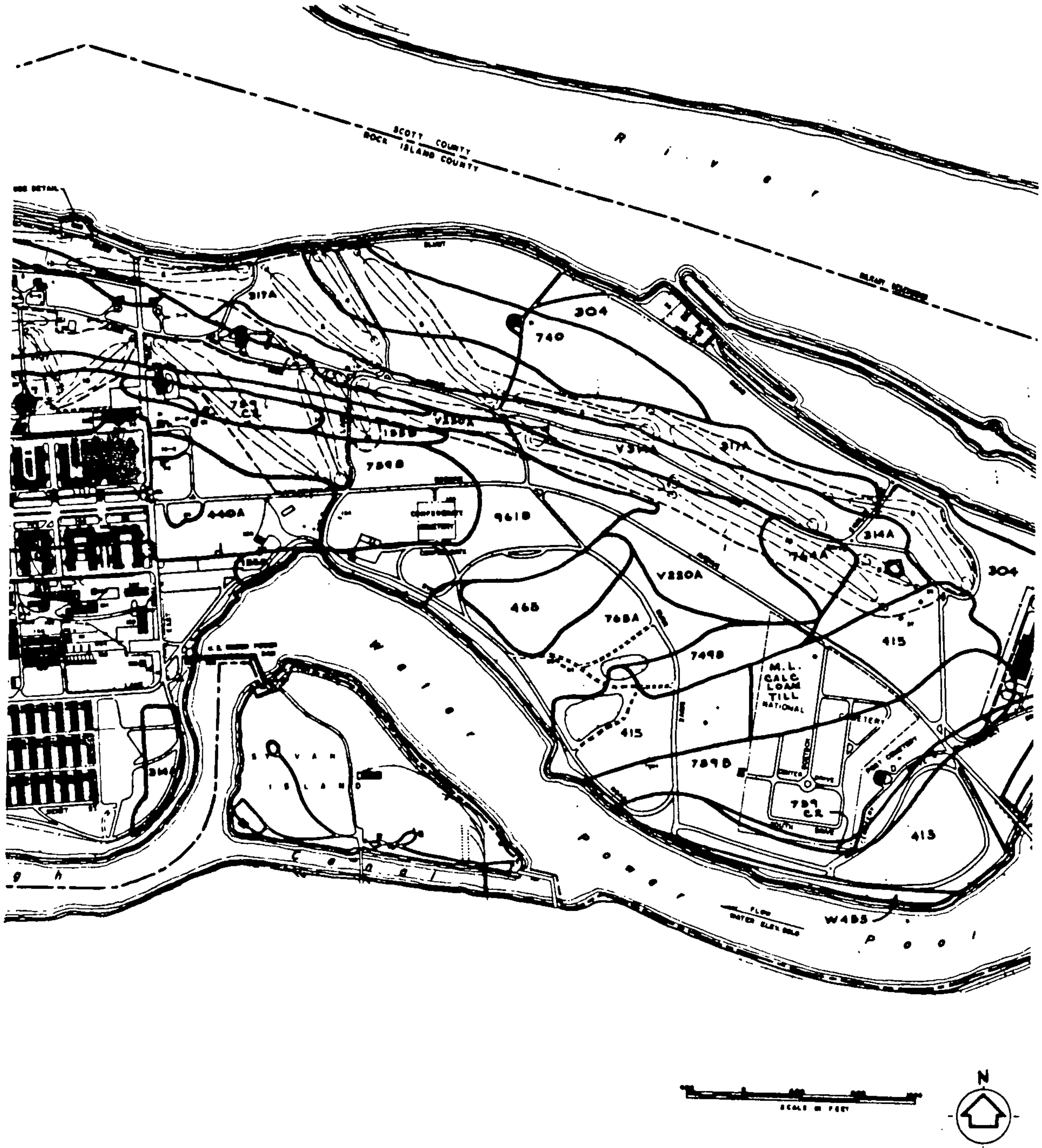



Figure 7b. Soil Survey Map

# TABLE II

## FOUNDATION BORING LOGS AT ROCK ISLAND ARSENAL

| Age | Stratigraphic Unit | Soil Type | Thickness (Meters) | Depth (Meters) |
|---|---|---|---|---|
| Quaternary | Alluvium and Glacial Drift | Gravel, sand, silt, clay | 0-7 | 0-7 |
| Devonian | Wapsipinicon | Limestone, dolomite | 122.6 | 7.0-129.6 |
| Silurian | Niagara | Limestone, dolomite | | |
| Ordovician | Maquoketa Group | Blue shale | 37.7 | 129.6-167.3 |
| | | Limestone | 7.6 | 167.3-174.9 |
| | | Blue Shale | 20.1 | 174.9-195.0 |
| Ordovician | Galena | Limestone, dolomite | 98.9 | 195.0-293.9 |
| | Decorah | Shale | 10.3 | 293.9-304.2 |
| | St. Peter | Sandstone | 30.4 | 304.2-334.6 |
| | Prairie Du Chien | Limestone, dolomite | 125.9 | 334.6-460.6 |
| Cambrian | Jordan | Sandstone | 26.2 | 460.6-486.7 |

Only isolated lenses of permeable soils contain water in the overburden. These soils are discontinous for the most part and generally will not provide avenues for widespread movement of contaminants. However, any near surface permeable soil in the vicinity of the landfill could permit contaminant migration into the Mississippi River.

The most widespread aquifers for small to medium water supplies in the area are in the Upper Silurian limestone. The shallowest aquifer is approximately 25 to 30 m below the surface. These aquifers underlie the brecciated, fractured, and somewhat cavernous Wapsipinicon limestone which is in direct contact with the unconsolidated overburden. Areas of potential contaminant migration occur in the old bedrock-floored sewer which may flow directly on this weathered limestone surface and in the caves in the subsurface beneath Building 299 where chemicals were stored. Vertical migration of contaminants through solution channels into the shallow aquifers may occur. Should any contaminants infiltrate the bedrock and enter the aquifer, they could migrate down and dip to the east and southeast.

The thick confining beds between the Silurian strata and the deeper sandstone aquifers should prevent any natural vertical infiltration of contaminants into the deeper sandstone aquifers which have been the main source of water for municipal and industrial users in the area.

F. Leases

There are no industrial, agricultural, or grazing leases at RIA. However, licenses, permits, and easements have been issued for utility service.

G. Legal Actions

There are no known legal actions filed against RIA relating to migration of contaminants.

## II. PAST AND CURRENT ACTIVITY REVIEW

### A. Installation Operations

#### 1. Industrial Operations

Industrial operations at RIA date back to the Spanish-American War. Early operations conducted at RIA included forging, smithing, tinning, production of gun carriages and powder cases, the manufacture and repair of small arms, operation of harness shops, and loading of ammunition. Later operations included the manufacture of automotive vehicles, demolition bombs and bomb racks, modification of aircraft engines, light tanks, recoil mechanisms, machine guns, rocket launchers, breech mechanisms, and Honest John and Nike Hercules launchers. More recent operations have included production of small arms, artillery components, recoil mechanisms, gun mounts, gun carriages, loaders, grenade launchers, and aircraft weapons subsystems. These operations are geared to prototype assistance, limited production orders, and orders for the production of repair parts with a critical national supply status. Current manufacturing operations include facilities for casting ferrous and nonferrous metals, sheet metal piercing and forming, forging, welding, plating, painting, operation of proof-firing ranges, paint stripping, machining, cleaning, lubricating, and metal surface treatment.

Liquid wastes from the above operations have been discharged and disposed of by various means throughout the mission of RIA. In the early years, the wastes were reported to have been discharged directly into the Mississippi River without treatment; however, no confirmatory data could be found in the records. The earliest available information (1941) indicates that combined wastewaters (domestic sewage, storm drainage, and industrial wastewater) from RIA were pumped to the City of Rock Island Regional Treatment Facility (RIRTF). This procedure continued until 1975-1976, when the RIA sewer system was separated into two systems. One system is used exclusively for storm drainage and surface runoff which are dischared into the river. The other system is used for the combined domestic and industrial wastewaters and those wastes which are still discharged to the RIRTF. The following summarizes the disposal of wastewater at various times:

| | Industrial Wastewater | Domestic Sewage | Storm Drainage |
|---|---|---|---|
| Prior to 1941 | Mississippi River | Mississippi River | Mississippi River |
| 1941 - 1976 | RIRTF | RIRTF | RIRTF |
| 1976 - Present | RIRTF | RIRTF | Mississippi River |

Pretreatment of industrial wastes prior to pumping to the RIRTF in the combined sewer was initiated in the early 1970's. This Industrial Waste Treatment Plant (IWTP) was in full operation in 1974 (see Section II.B.1.b).

Industrial wastes resulting from past and present operations at RIA are listed in Appendix D.

Wastes from the machine shop were taken to the landfill (2)* on the south side of RIA until the 1960's. Oil-water coolants were dumped on the ground; cutting oil was deposited in pits and burned. The pits were also used for dumping waste cellulose acetate butyrate and sludges from degreasers and petroleum solvents. Waste cyanide heat-treating salts were taken to the landfill until the mid-1960's. These salts have since been neutralized in the plating shop.

Since 1973, waste oils, spent solvents, and other concentrated liquid waste sludges have been collected in 55-gallon drums or in an underground oil storage tank (4) for collection by a contractor for approved disposal.

Reclaimable wastes, including metal chips mixed with soluble and insoluble machining oils, are sent to the Defense Property Disposal Office.

Some industrial wastes at RIA are pretreated in the IWTP (8) prior to discharge into the sewer. As the occasion arises, caustic cleaning baths, neutralized spent pickle liquor and spent battery acid are sent to the IWTP for pretreatment. Steam boiler blowdown, water softening waste and forge shop furnace cooling water are discharged directly to the sewer.

In the past, minor leakage may have occurred during the temporary outside storage of waste plating chemicals, thus resulting in some local ground contamination. Currently, a variety of industrial wastes, including cyanide and chromium salts, are stored in drums in Building 175 (9) in the "XYZ" Area (13) pending pickup by a contractor for approved disposal.

2. <u>Lessee Industrial Operations</u>

There is no record of lessee industrial operations having taken place at RIA.

*Numbers in parentheses are referenced in Figures 8a, 8b, and 8c.

Pages 28-32 are non-responsive

6. Toxic/Hazardous Materials - Handling and Storage

a. Industrial Chemicals

Considerable amounts of commercial chemicals are stored at RIA: flammable organic materials (oils, thinners, solvents, paints, etc.), industrial acids and bases, cyanide salts, and other chemicals utilized in their laboratories.

An extensive listing of the known and suspected carcinogens stored at RIA was compiled by USAEHA.[1] Most of these are associated with various laboratories and industrial operations.

There are some separate-loading propelling charges and small arms ammunition in magazine storage (15) and at location (16).

Five capacitor banks and twenty-two transformers containing polychlorinated biphenyls (PCB's) are in use at RIA. These items and their locations are listed in Appendix E.

Drums containing chromium-contaminated sludge from the IWTP and waste cyanide salts from the heat treatment baths are stored in Building 175 (9) pending removal by contractor. No provisions were observed in the storage area for the containment of potential leakage.

RIA has an open-storage coal stockpile at location (17). The stockpile generally contains about 20,000 metric tons of coal. Cinders generated from coal burning are stored at location (18). These cinders are used by surrounding communities for spread on icy streets.

Several oil and fuel storage sites are located throughout RIA.

b. Chemical Agents

According to available records, there are no toxic chemical agents at RIA.

c. Biological Agents

According to available records, no operations with biological agents were ever conducted at RIA.

d. Radiological Materials - Permits and Licenses

RIA has been involved with radiological materials since the early 1950's. Most of this work included tracer studies, irradiation tests of materials, and other research and development work. Isotopes used in these studies included hydrogen-3 (tritium), carbon-14, phosphorus-32, sulfur-35, iron-59, cobalt-60, zinc-65, and strontium-90. High energy irradiators with cobalt-60 sources were located in Buildings 104 and 110.

The repair and rebuild of items containing radioactive materials occurred during the 1960's and 1970's. These items were various vehicles which utilized gauges with dials containing radium activated phosphorus. The gauges containing radium were removed and disposed of in accordance with AR 15-55. They were replaced with nonself-luminous gauges.

The present operations at RIA are covered under NRC License No. 12-00722-02, expiration date 20 September 1982, and Authorization No. A12-72-02, expiration date 30 November 1982. The authorization covers a static eliminator bar (Polonium-210). The NRC license covers sealed sources which include Cobalt-60, Strontium-90, Hydrogen-3, and Cesium-137. Other sealed sources for use with various radioactive items of supply are covered by the appropriate commodity licenses issued by the NRC. Radioisotopes authorized by these licenses include Hydrogen-3, Cobalt-60, Krypton-85, and Promethium-147. Exact quantities of Carbon-14, Chlorine-36, Technetium-99, Bizmuth-210, Radium-226, and Thorium-230 are in sources used to calibrate laboratory radiation detection equipment.

e. Pesticide/Herbicide/Fertilizer Usage

Appendix F summarizes the amounts of concentrated pesticides (insecticides and herbicides) used at RIA during a twelve-month period. Pesticides are stored in two seperate rooms in Building 139 (19) which were secure and posted with "PESTIDICE STORAGE AREA" and "RESTRICTED" signs. The entrances to the pesticide storage rooms were equipped with switches to activate the ventilation system. The stored pesticides were visibly labeled and the neatly maintained rooms had concrete floors, with no drains and a curbing at each door to prevent leakage.

Prior the 1955, Building 11 (21) was a storage facility for pesticides. A tour of the building, now used exclusively for community functions, revealed no stored chemicals or equipment.

Empty containers were routinely triple rinsed in a maintenance yard adjacent to Building 133 (20). Rinse water for insecticides and herbicides was maintained in two separate 55-gallon drums. This water was collected after each rinse cycle and reused.

Fertilizers are applied in early spring and fall. No surplus fertilizers are stored at RIA. Fertilizer (16-18-8) is used at a concentration of 5.4 kilograms (kg) per 90 square meters.

A 68 ha golf course is presently leased to a private contractor. A pesticide and fertilizer program is maintained by the operator and must meet regulations established by RIA Roads and Grounds. Monthly reports on pesticide application submitted to RIA are included in Appendix F.

## B. Disposal Operations

### 1. Liquid Waste Treatment

#### a. Sanitary Wastewater Treatment

The earliest available information (1941) indicates that the wastewaters (domestic sewage, storm drainage, and industrial wastewater) from RIA were pumped to the RIRTF and then into the Mississippi River. It appears that wastes were discharged directly to the river prior to 1941.

In 1975-1976, the sewer system was separated into two systems: one exclusively for storm drainage which discharges into the river, and the other for combined domestic and industrial wastewaters which discharge to the RIRTF (see Section II.A.1).

There has never been a sewage treatment plant at RIA. The combined wastewaters are pumped via Pump House Building 204 to the RIRTF. The RIA wastewaters discharged to the Treatment Facility must and do meet effluent limitations imposed by the City of Rock Island (see Table III).

The five septic tank systems serving remote areas of the installation do not discharge to the river. These septic tanks were last cleaned out in 1975.

#### b. Industrial Wastewater Treatment

Throughout the history of RIA, untreated industrial wastewater from specific areas went directly into the sewer system. This includes the dilute wastes from the various research and development laboratories, the rinse waters from the photoprocessing laboratory, waste from the phosphating operations in Building 58, softener regeneration wastewater and boiler blowdown from the heating plants, and the sludge from the sedimentation tanks in the WTP.

The remainder of the industrial wastewater is appropriately pretreated (neutralized, filtered, chemically degraded) before it is discharged to the RIRTF.

The metal plating shop in Building 64 (1) has facilities for cadmium, copper, chromium, lead, nickel, and zinc plating. Two types of wastewater result from these operations: one contains high metal concentrations and the other has a high cyanide concentration. These two types of wastewater require different treatment and are kept separate. Information regarding the treatment of these waste streams in the 1940's was not available.

TABLE III

EFFLUENT LIMITATIONS FOR WASTEWATER DISCHARGED TO THE CITY OF ROCK ISLAND REGIONAL TREATMENT FACILITY

| *Parameter* | *Maximum Allowable Concentration (mg/l)* |
|---|---|
| Nitrogen (Ammonia) | 2.5 |
| Arsenic | 0.25 |
| Barium | 2.0 |
| BOD (5-day) | 300 |
| Cadmium | 0.15 |
| Chromium, Hexavalent | 0.3 |
| Chromium, Trivalent | 1.0 |
| Copper | 1.0 |
| Cyanide | 0.00 |
| Fluoride | 2.5 |
| Iron (Dissolved) | 0.5 |
| Iron (Total) | 2.0 |
| Lead | 0.1 |
| Manganese | 1.0 |
| Mercury | 0.0005 |
| Nickel | 1.0 |
| Oil | 15.0 |
| pH (Units) | 5.0-10.0 |
| Phenols | 0.3 |
| Selenium | 1.0 |
| Silver | 0.1 |
| Suspended Solids | 350 |
| Zinc | 1.0 |

From 1950 to 1970, much of the metal-containing wastewater went to the combined sewers. Chromic acid waste solutions were regenerated by filtration and cationic ion exchange. The ion exchange resin was regenerated with sulfuric acid and the untreated regeneration wastes were discharged to the combined sewer. The cyanide-containing wastewater was batch treated in an alkaline chlorination unit and the treated wastewater was discharged to the sewer. Waste pickling solutions containing sulfuric and phosphoric acids were neutralized before discharge to the sewer. Until 1965, the sludges and solid wastes from these operations were put into the landfill (2).

The industrial waste treatment plant [capacity 450 liters per minute (l/min)] in Building 65 (8) started operations in the early 1970's and it was in full operation by 1974. The plant then consisted of the neutralization-chrome reduction tanks, a tank for adding a polyelectrolyte, a clarifier for sludge separation, and a reverse osmosis unit. In addition, the plant had two centrifuges for dewatering clarifier sludge and a multiple-hearth furnace for drying the dewatered sludge. This plant theoretically has the capability to process all plating wastes, except for cyanide, with complete recycle of the treated water back to the plating shop. However, the membranes in the reverse osmosis unit constantly became fouled and in 1977, this unit was removed from the treatment scheme. At present, the effluent from the clarifier is discharged to the combined industrial/domestic sewer. During the early years of IWTP operation, the dried sludge was taken to landfills in Iowa and Illinois by a private contractor. Until 1978, the disposal of this sludge was not coordinated with State and/or Federal regulatory authorities.[2] IWTP sludge is presently stored in 55-gallon drums in Building 175 (9) awaiting disposal by a contractor.

There are two cyanide treatment operations at RIA. The alkaline chlorination unit, located outside the west wing of Building 64 (1), effects complete cyanide destruction. A Savsol unit, located at the east wing of Building 64, uses a continuous evaporation recovery technique to reclaim wash water from plating operations and collect cyanide-containing sludge. Because these treatment systems have had operational difficulties at various times, much of the cyanide-containing wastes have been landfilled without treatment. At present, the cyanide-containing wastes are disposed of by a contractor.

Some industrial wastes generated in relatively small quantities are collected in holding tanks and transported to the IWTP for treatment. Included among these are the spent battery acid (about 7,600 liters per year) from the battery shop in Building 251 and the waste solutions from the phosphating shop in Building 58.

At present, the effluent from the IWTP is well within the limitations set by the RIA Treatment Facility.

c. Holding Ponds

There are no holding ponds at RIA.

2. Solid Waste Treatment

a. Sanitary Landfill

RIA does not have a sanitary landfill and domestic waste is removed by a private contractor.

Two industrial fill areas (22 and 23) were used until the mid-1970's for the disposal of concrete, cinders, and construction rubble.

b. Contaminated Waste

A landfill area in the southern part of the installation was also used for the disposal of industrial waste until the mid-1960's. This waste included oily sludges, waste oil-water coolant from the machine shop, waste cyanide salts, sludges from the plating shops, and solutions contaminated with chromium and zinc.

Most of the material that had been put into the landfill is now removed under contract by commercial waste removal firms. Inert refuse is removed by a commercial contractor to a private landfill in Andalusia, Illinois, regulated by the Illinois State EPA. The specification for this collection and disposal is given in Appendix G.

The industrial-type waste (IWTP sludges, cyanide salts, grinding material, incinerator waste, etc.) is removed by a chemical waste handling firm to a secure landfill. The specification for this collection and disposal for solid waste is included as Appendix H. RIA has a contract for disposal of industrial type waste to a contractor-operated landfill in Emelle, Alabama.

The POL-type industrial waste that had been spread on the ground or burned in the landfill is now removed for reclamation or disposal by a private contractor. Waste cutting and grinding oils, lubricants, and other oil products used in the machining operations are collected in an underground 57 cubic meter ($m^3$) holding tank at location 216 (4). Waste oil from the motor pool is collected in a holding tank at Building 159. Spent hydraulic fluid from the foundry and waste POL from the rebuild and forge shops are sent to the oil holding tank at location 216. Water base cutting fluids are collected in three underground 57 cubic meter ($m^3$) holding tanks at location 216. A one $m^3$ tank near Building 254 has not been used since 1977. The RIA specification for disposal is given in Appendix I. The POL disposal is regulated by the Illinois EPA whose permit application form is presented in Appendix J.

Some of the past waste POL has been used in Iowa for oiling roadways. This practice was to have been terminated by December 1979.

In the 1950's, radioactive wastes were shipped to Edgewood Arsenal, Maryland, in accordance with Army regulations. Since then, the wastes have been disposed of in compliance with NRC regulations at a nuclear disposal site at Snelling, South Carolina.

In 1978, six concrete-filled bomb casings were discovered in the woods at the test track (14). The casings were similar to those manufactured for atomic bomb research in the 1940's. An X-ray analysis revealed only the presence of a few nuts and bolts in addition to the concrete in these casings and the radiation level measured was about twice the background level (considered negligible). Nevertheless, these items were eventually shipped to Chem-Nuclear Systems, Inc., Snelling, South Carolina, for disposal as low-level radioactive waste (less than one millicurie per container). The six items were shipped by contractor in September 1978. A seventh casing, discovered during the team visit in April 1979, was partially buried in the same general area where the original six casings had been found.

3. Demolition and Burning Ground Areas

An area of Rock Island parallel to the Sylvan Slough was used as a burning ground (2) from World War I to 1970. Reports indicate that all types of industrial wastes were burned there. This area has also been used as a burial ground.

From 1870 to 1880, an area near Building 154 was the location of a demolition and burning pit (26). The area is referred to as the Shell breaker and explosive pit. Civil War and Spanish-American War munitions were destroyed at this location.

4. Demilitarization

Gun barrels and other metal items are melted at RIA. The deactivation furnace is used to degrease and/or remove preservatives or paper from metal items prior to melting. Spent shell cases are sent to Savanna Army Depot for disposal.

5. Miscellaneous

There is no record of spills, accidents, or incidents.

C. Water Quality

The Mississippi River is the primary source of the water supply at RIA. The water is pumped from the inlet on the north shore near Building 9 (27) to the WTP at Building 50 (10). Following treatment with chlorine, alum, lime, and activated carbon in a rapid mix tank, the water is pumped through coagulation, flocculation, and sedimentation tanks in series. After rapid filtration through sand, the water is stored in a 2,840 $m^3$ clear well. The water is chlorinated prior to entering the distribution system. [redacted]

[redacted]

[redacted]

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[redacted]

[redacted]

Water from these wells is chlorinated at the well site before entering the respective distribution systems.

In addition to the clear well and the ground storage reservoir, the system also has a 1,890 $m^3$ elevated storage tank. This tank supplies water at night when the WTP pumps are not operating.

Residual chlorine is monitored twice daily at the WTP. Bacteriological monitoring is performed by the City of Rock Island (8 analyses per month) and the State of Illinois (6 analyses per month). Both of these laboratories are USEPA certified. RIA is applying for USEPA certification of the WTP laboratory.

Raw river water, water from the clear well, and water from each of the four wells are analyzed annually by USAEHA. Data from the samples taken in February 1978 indicate satisfactory water quality.[2] Water was not tested for organic, PCB, or explosive compounds.

1. Surface

No evidence of contaminated surface water was found. The water in the quarry (25) apparently has never been analyzed and the storm drainage outfalls are not monitored. The ground around the waste POL holding tanks (4) is oil-stained. The water runoff from the outdoor coal pile storage area (17) was tested under a contract let by the Omaha District, Corps of Engineers (Appendix K). A grab sample taken from a ponding area near the coal piles had an iron content which exceeded acceptable limits [4.62 milligrams per liter (mg/l) versus 1.0 mg/l, the Illinois EPA standard], but was otherwise acceptable. The study indicated that no significant water quality hazard was associated with the coal piles even though runoff water percolated into the tree-covered soil near the stockpile.

## 2. Subsurface

[redacted]

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The possibility of contamination of the groundwater by seepage from the landfill (2) was studied under a contract let by the Omaha District, Corps of Engineers (Appendix L). Five wells were drilled to bedrock at the southern perimeter of the landfill. Depth of bedrock varied from 3 to 7 m with a significant slope in a southwestern direction. Groundwater was encountered at roughly 2 to 4 m below the surface, but the depth varied with river height. The quality of water samples taken from the wells were within the Illinois standards. The materials removed from the wells during drilling were analyzed by an extraction procedure recommended by the Illinois EPA. The results indicated that the soil samples contained significant amounts of oil, and in one case, an excessive amount of iron. However, the water samples were of acceptable quality. Based on these results, the probability of significant movement of oil or heavy metals from the landfill to the groundwater was considered to be extremely small.

## III. INSTALLATION ASSESSMENT

### A. Findings

#### 1. Biota

Vegetative cover exists over most of the installation with the exception of those areas covered with asphalt, concrete, or gravel. Little unused acreage is available for the development of a wildlife program. The region which encompasses RIA is considered a possible habitat for several protected species (Illinois mud turtle, bald eagle, and the plains hognose snake). Two mussel species, presently found in the Sylvan Slough south of the installation, are reported to be protected by available means.

#### 2. Geology

RIA is relatively flat and underlain by rock which is close to the surface of the ground. Very shallow soil depths exist in the central region of the island. Groundwater levels vary with the water levels of the Mississippi River and the Sylvan Slough. The entire island is drained mechanically or controlled by vegetation or relatively gentle slopes. No large swampy areas exist on the island; however, portions of the island, especially on the southern border, are subject to flooding.

#### 3. Legal Actions

There are no past or present legal actions relating to migration of contaminants.

#### 4. Industrial Operations

Operations which have a potential for generating contamination have included silver-brazing (cadmium-bearing filler metals), vapor degreasing, lubricating, welding, painting, metallizing, weapon firing (lead deposits, cleaning solvents). laboratory chemical analyses, plating, foundry operations, and abrasive blasting.

Until 1978, chromium-plating sludges were removed by a private contractor to his private landfill. This waste is now drummed, together with cyanides and other industrial wastes, and stored until a new contract is let for removal. Until approximately 1950, chromium and other wastes were sent to the Rock Island STP as were other industrial wastes. Some wastes, including cyanide heat-treating salts, oily sludges (vapor degreaser operations), lubricants, paint residues, and lead and zinc chromates were buried in a landfill area behind Building 299, at the edge of the Mississippi River (1940 to late 1950's or early 1960's).

Eighteen transformers and five capacitor banks (all PCB-type) are used onpost.

5. Laboratory Operations

The laboratory in Building 110 serves to support RIA manufacturing processes. RIA also has water analysis laboratories in the WTP and boiler plant, and four photography processing laboratories. Most laboratory wastes are discharged to the sanitary sewer system; hydraulic fluids and petroleum oil wastes are stored in appropriate holding areas for final disposition by recycling processing. The photography processing solutions go to DPDO for silver reclamation.

6. Materiel Proof and Surveillance Tests

A small proving ground was constructed on the eastern part of the arsenal in 1904. In the early years of its use, weapons ranging up to 3" field guns and 4.7" siege guns were tested (all inert rounds); more recently, inert rounds up to 105mm have been fired there.

7. Toxic/Hazardous Materials - Handling and Storage

There are no toxic chemical agents, but large amounts of laboratory and industrial chemicals are stored in various buildings. There are separate buildings for acids, bases, compressed gases, flammables, and cyanide salts. Radioactive materials are in Buildings 108 and 110. Small arms ammunition and howitzer propellant charges are stored in magazines in the southcentral sector and near the range.

No chemical or biological weapons were manufactured, stored, or tested. RIA produced inert hardware for nuclear weapons work in the 1940's. RIA has worked with radiological materials since the 1950's. Radioactive calibration sources are located onpost. RIA has one NRC license and a DA authorization for the use of radioisotopes.

8. Pesticide/herbicide/Fertilizer Usage

Pesticides used at RIA are stored in two separate rooms in Building 139.

Fertilizers are applied in early spring and fall. No surplus fertilizers are maintained by RIA.

9. Sanitary Wastewater Treatment

Earliest available information (1941) states that combined domestic, industrial, and storm waters were pumped to the City of Rock Island Treatment Facility. Some wastes went directly to the Mississippi River. In 1975-1976, storm sewers were separated from the domestic/industrial sewers; storm sewers discharged to the river, the others went to the city plant. Effluent to the city plant meets limitations imposed by city ordinances.

Five remotely located septic tank systems have no discharge and were last cleaned out in 1975.

10. Industrial Wastewater Treatment

Some untreated industral waste goes directly to the domestic/industrial sewer. This includes dilute wastes from the laboratories, softener regeneration wastewater and boiler blowdown from the boiler plant, rinse waters from the photoprocessing laboratory, dragout from the rinse tanks in the phosphating operations, and sludge from the sedimentation tanks in the IWTP.

Wastewater from plating shops is pretreated to reduce hexavalent chromium to trivalent chromium. The trivalent chromium and other heavy metals are flocculated out of the wastewater, and the clarified wastewater is pumped to the RIRTF. Drums of IWTP (chromium containing) sludge and waste cyanide salts are stored in Building 175 pending removal by contractor.

11. Sanitary Landfills

There is one large landfill in the southcentral part of the island used from approximately 1918 to the late 1960's.

Two industrial fill areas were used up to the 1970's for rubble, cinders, concrete, etc. Burial of cyanide salts in one of these areas was reported, but could not be confirmed.

12. Water Quality

[redacted]

[redacted] Redactions on this page are non-responsive [redacted]

[redacted]

B. Conclusions

1. The primary contaminants from the industrial operations are heavy metals, cyanide salts, POL, and organic solvents.

2. The most heavily contaminated onpost sites are presumed to be the old landfill south of Building 299, the "XYZ" Area, and the industrial fill area located northwest of Building 299.

3. The most likely routes for offpost migration of contaminants are via surface runoff and shallow underground water flow into the Mississippi River.

4. Both the USAEHA analysis of the wells at RIA and the Corps of Engineers water pollution study of the landfill area indicate that contaminants are not migrating to the initial aquifer below bedrock or to the shallow groundwater.

5. There is no provision for the containment of accidental leakage from the drums of IWTP sludge and cyanide salts stored in Building 175.

C. Recommendations

1. That no preliminary survey be conducted at this time.

2. That a berm or similar means be built around the drums of chemical waste stored in Building 175 to contain any accidental spillage or drum leakage.

# REFERENCES


1. USAEHA, Industrial Hygiene Survey No. 66-0170-78, 6-10 Feb 1978.

2. USAEHA, Water Quality Engineering Consultation No. 24-0048-78, 7-15 Sep 1977.


# ADDITIONAL REFERENCES


<u>History</u>

3. "A History of Rock Island and Rock Island Arsenal from Earliest Times to 1954," Volumes I, II, and III, May 1962.

4. "A Synopsis of Events on Rock Island from 1954 through 1965."

5. "A Brief Chronological History of Rock Island Arsenal."

<u>Geology</u>

6. "Milan Geologic Science Field Trip," 31st Annual Tri-State Geology Guidebook, Augustana College, Rock Island, Illinois, Oct 1967.

7. "Guide Leaflet Geologic Science Field Trip-Milan Area," Illinois State Geological Survey, May 1975.

8. "Water Pollution Study for Rock Island Arsenal," Rock Island, Illinois, Omaha District, U. S. Corps of Engineers, Omaha, Nebraska, prepared by Harland Bartholomew and Associates, Northbrook, Illinois, 23 Mar 1979.

9. "Environmental Impact Assessment Rock Island Arsenal, Rock Island, Illinois," Omaha District, U. S. Corps of Engineers, Omaha, Nebraska, 24 Mar 1976, revised 9 Apr 1976 and 1 Nov 1978.

10. Willman, E. B., et al., Geologic Maps of Illinois, Illinois State Geological Survey, Urbana, Illinois, 1967.

11. Tester, A. C., Geologic Maps of Iowa, Iowa Geological Survey, 1937.

12. Hansen, R. E., "Bedrock Topography of East-Central Iowa, Map I-717," U. S. Geological Survey, Washington, D. C.

13. Wahl, K. D., et al., "Water Resources of East-Central Iowa," Iowa Geological Survey Water Atlas Number 6, U. S. Geological Survey, Washington, D. C., 1978.

Environmental

14. Installation Environmental Impact Assessment, Rock Island Arsenal, 1 Nov 1978.

15. Installation Natural Resources Report, Part I - Land Use and Conservation, Fiscal Year 1978.

16. Pest Control Summary Report, DD-1532. Last 12 Monthly Reports.

17. Installation Pest Management Program, No. 66-0521-77, Rock Island Arsenal, Rock Island, Illinois, 14-18 Jun 1976.

18. Report of Entomological Liaison Visit, Rock Island Arsenal, Rock Island, Illinois, 4-5 Apr 1972.

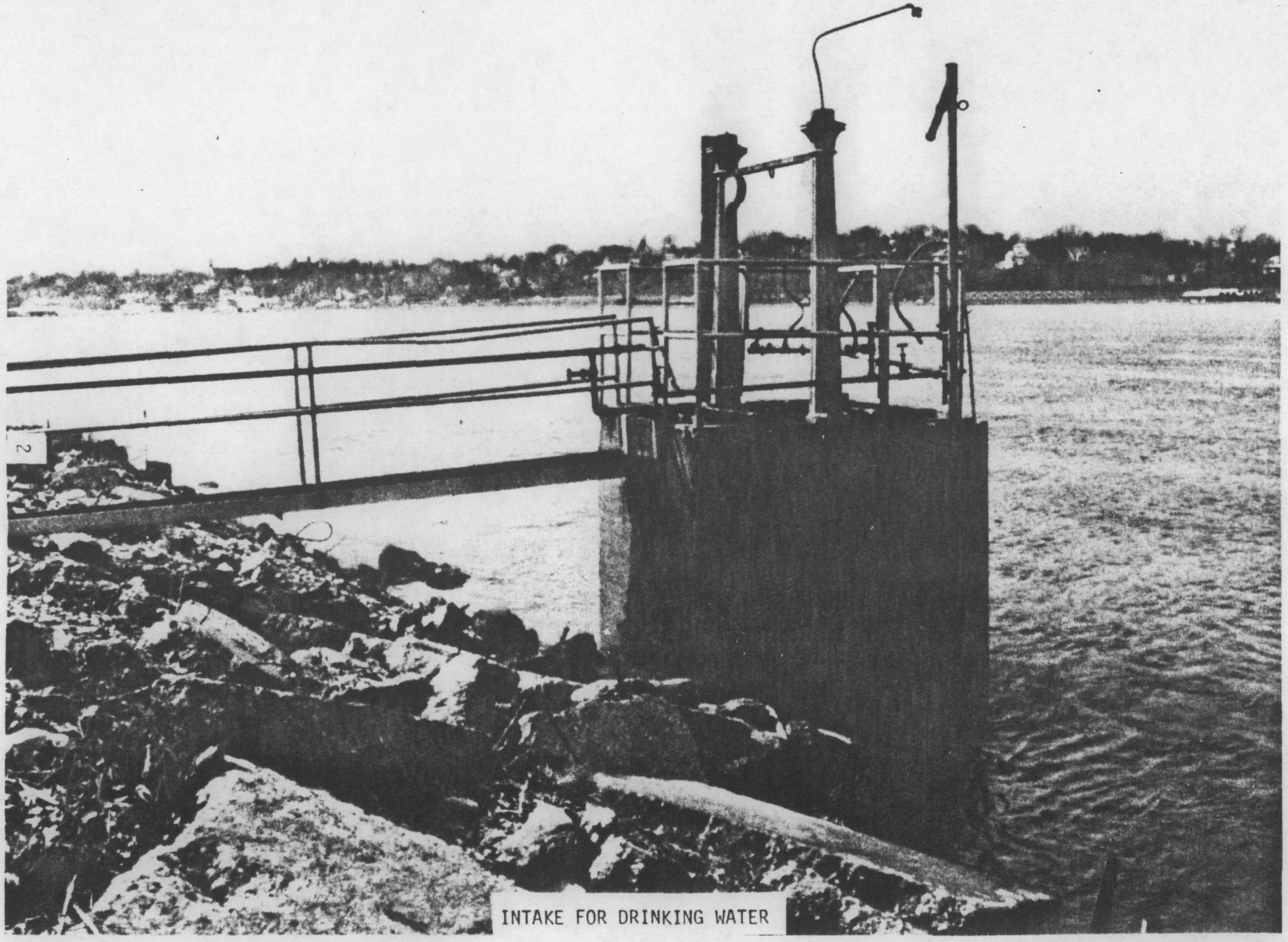
19. Report of Entomological Survey and Liaison Visit, Rock Island Arsenal, Rock Island, Illinois, 4-7 Mar 1974.

APPENDIX A

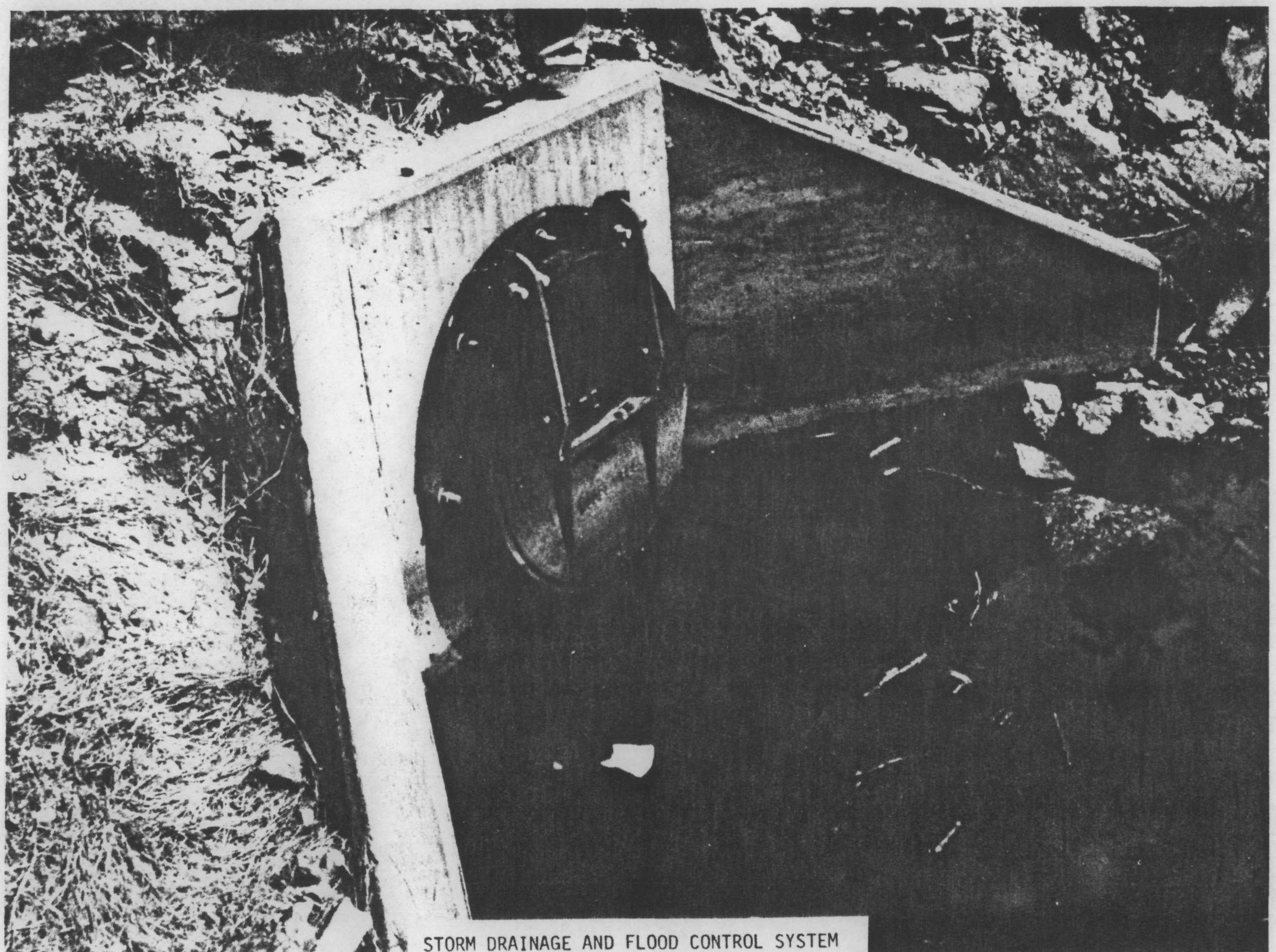
Photographs

of

Rock Island Arsenal



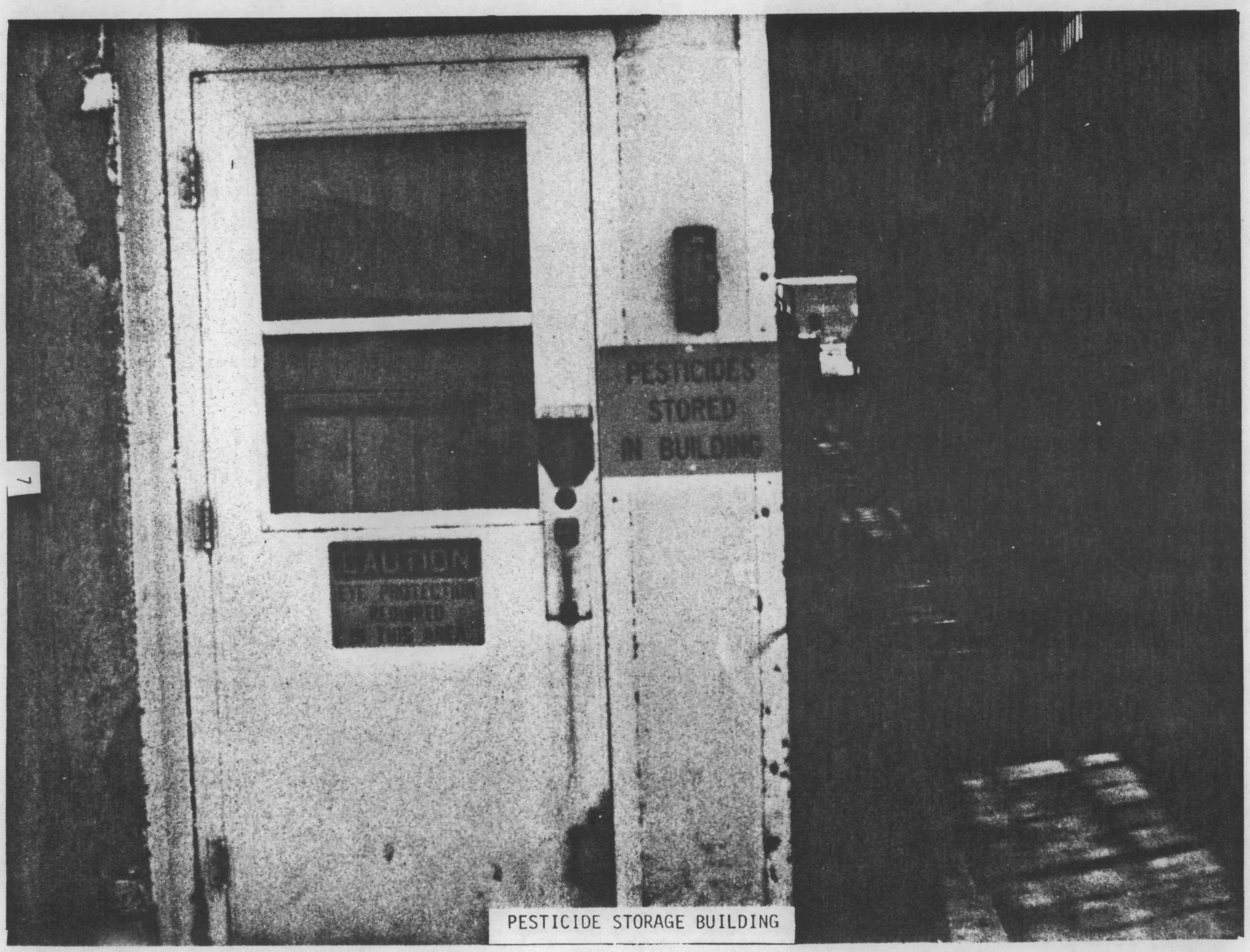
INTAKE FOR DRINKING WATER



STORM DRAINAGE AND FLOOD CONTROL SYSTEM

OIL TANK STORAGE AREA

Pages 53 and 54 are non-responsive




PESTICIDE STORAGE BUILDING

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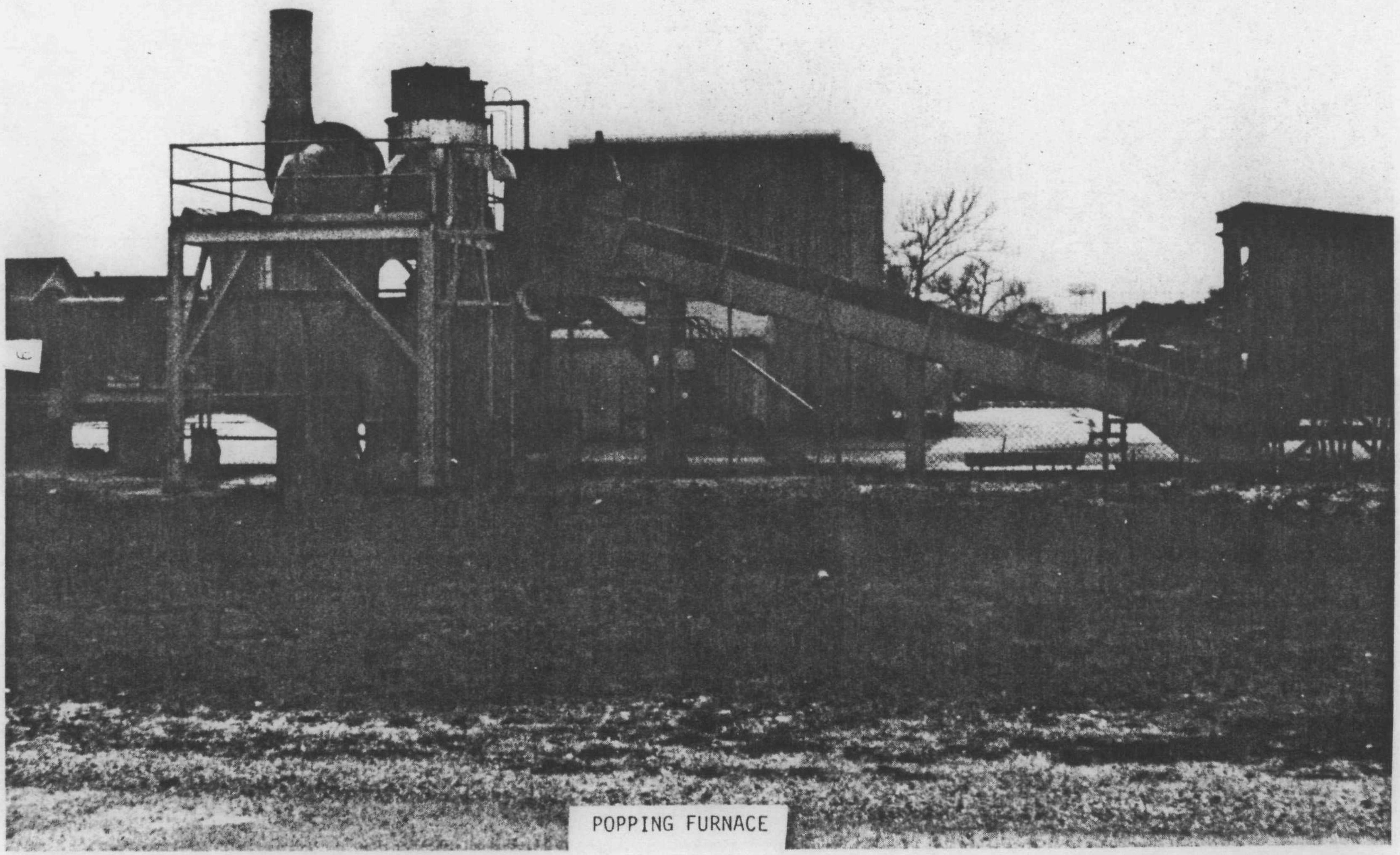
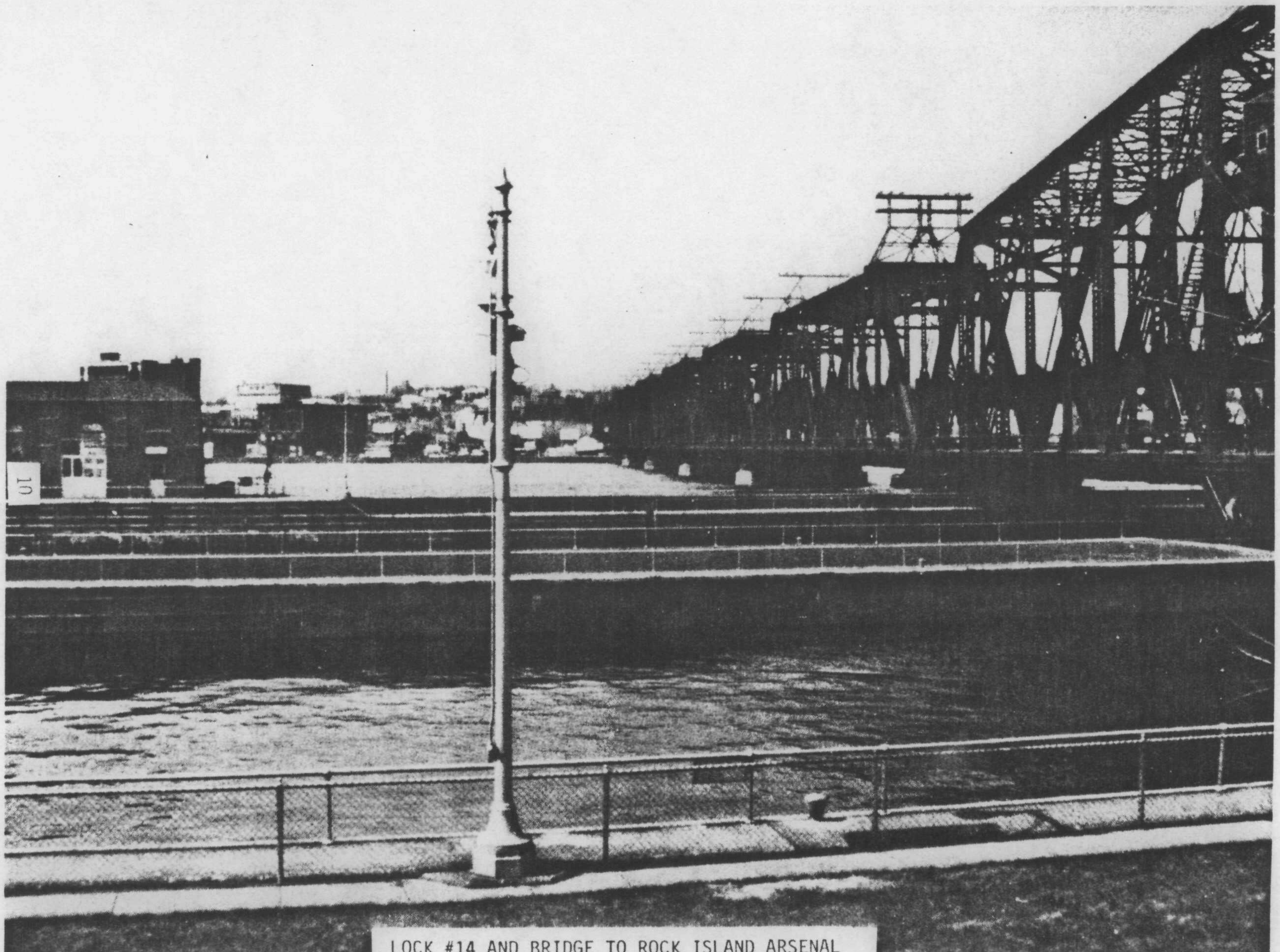
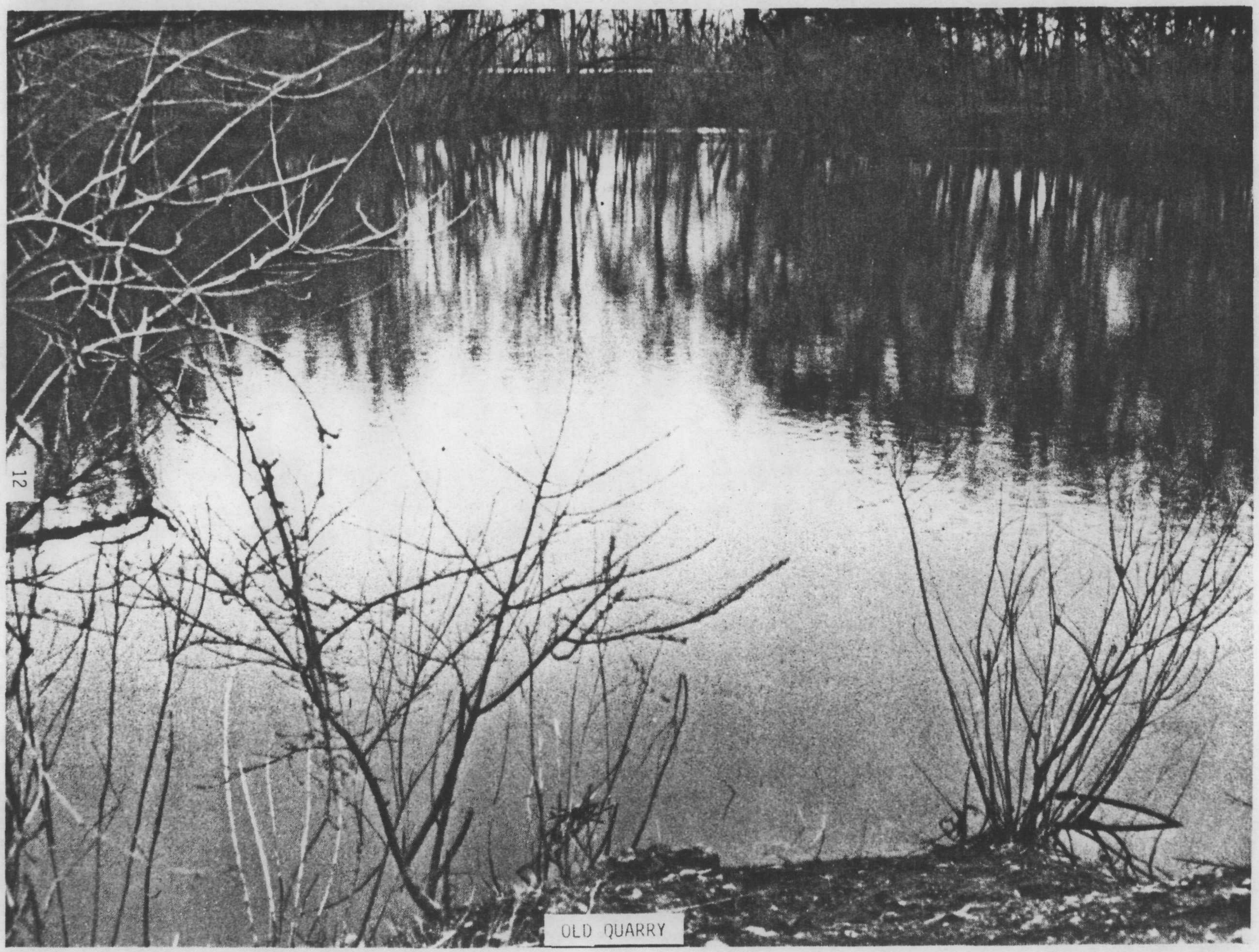


POPPING FURNACE



LOCK #14 AND BRIDGE TO ROCK ISLAND ARSENAL


OLD BRIDGE



OLD QUARRY

Non-responsive

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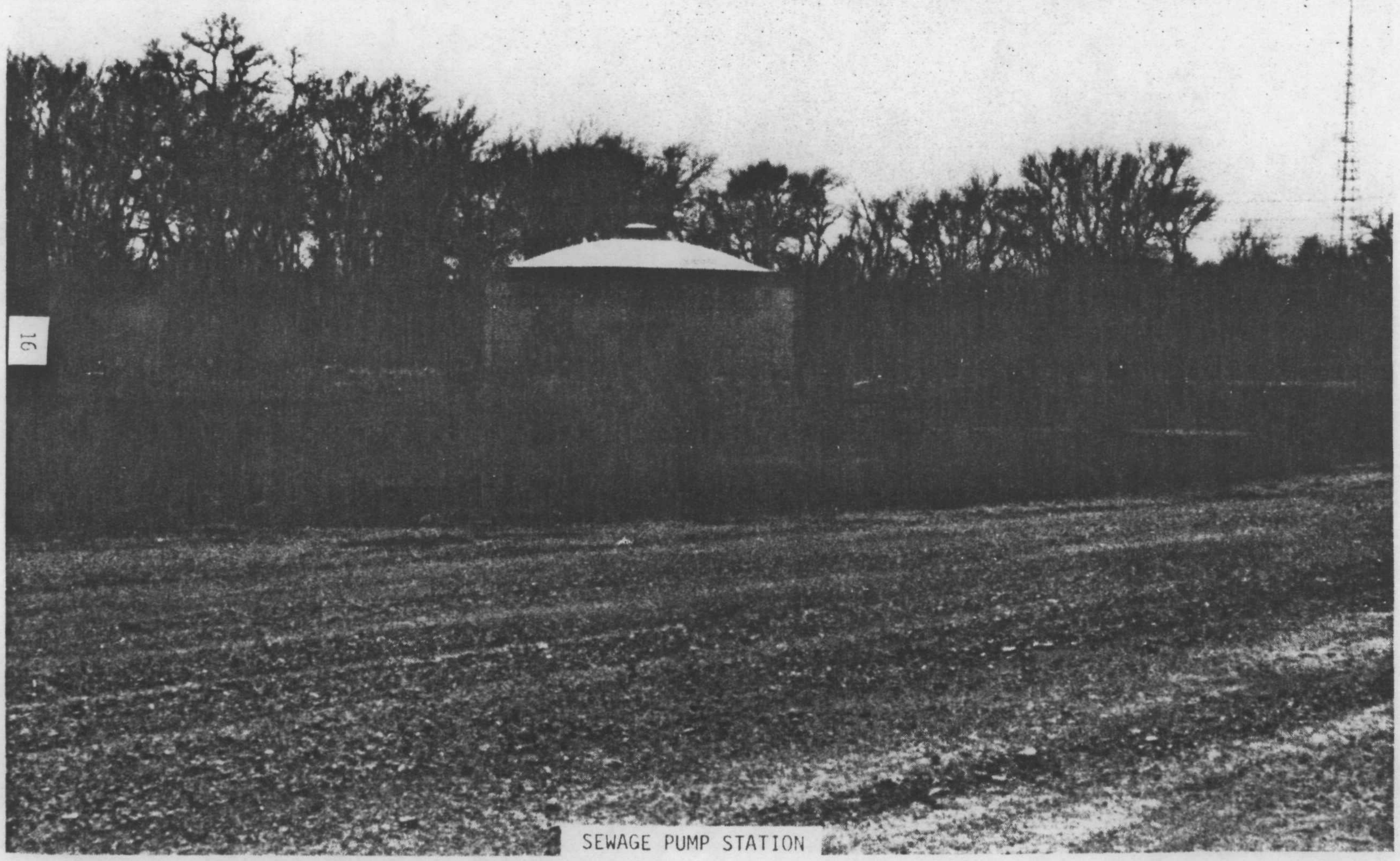
FILL AREA BETWEEN CORPS OF ENGINEER BUILDING AND THE SYLVAN SLOUGH

COMMUNITY CENTER



SEWAGE PUMP STATION

17

PROPERTY DISPOSAL STORAGE AREA

Non-responsive

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FLOODING NEAR OLD LANDFILL

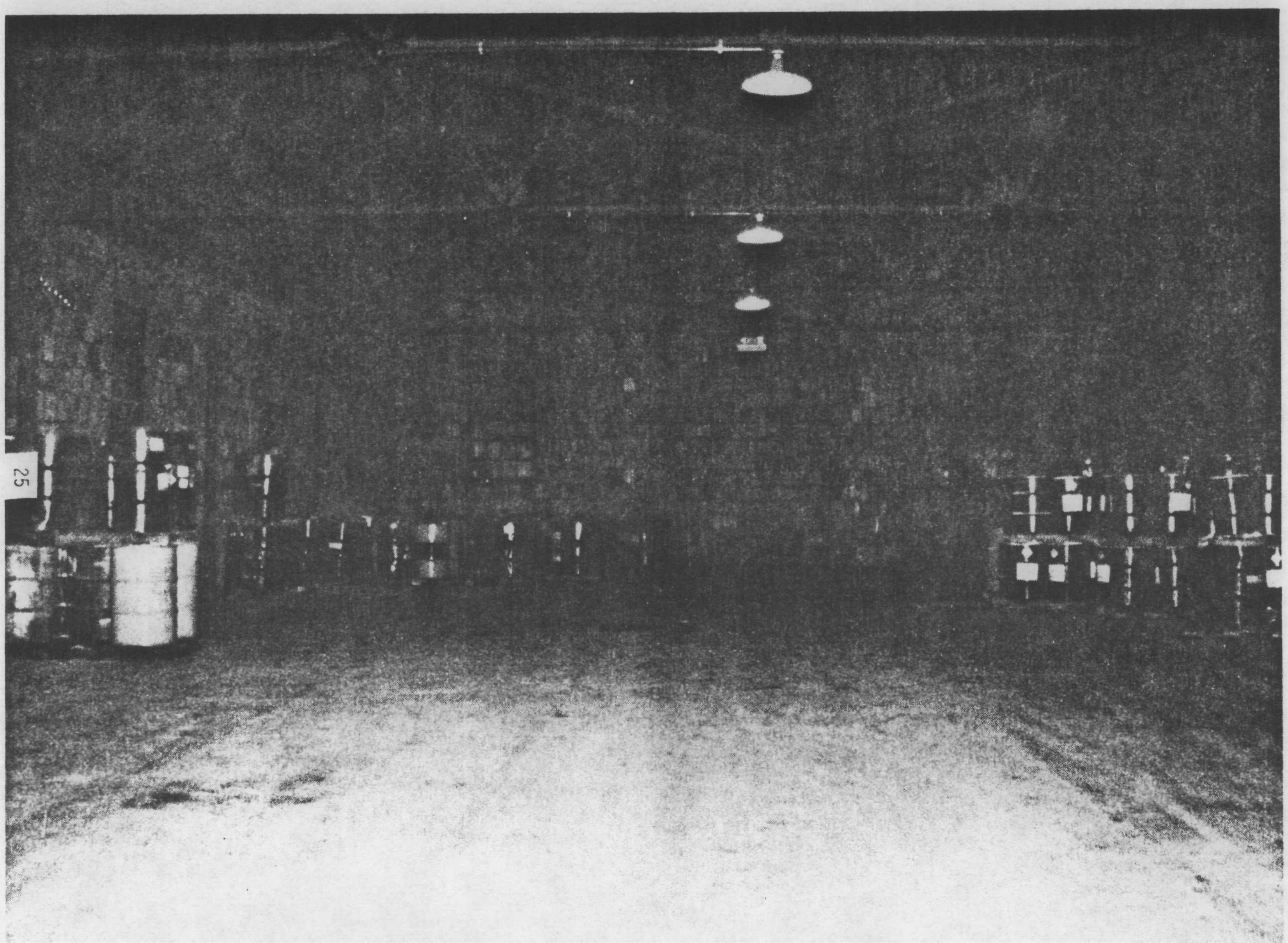
OLD LANDFILL AREA LOOKING NORTH

22

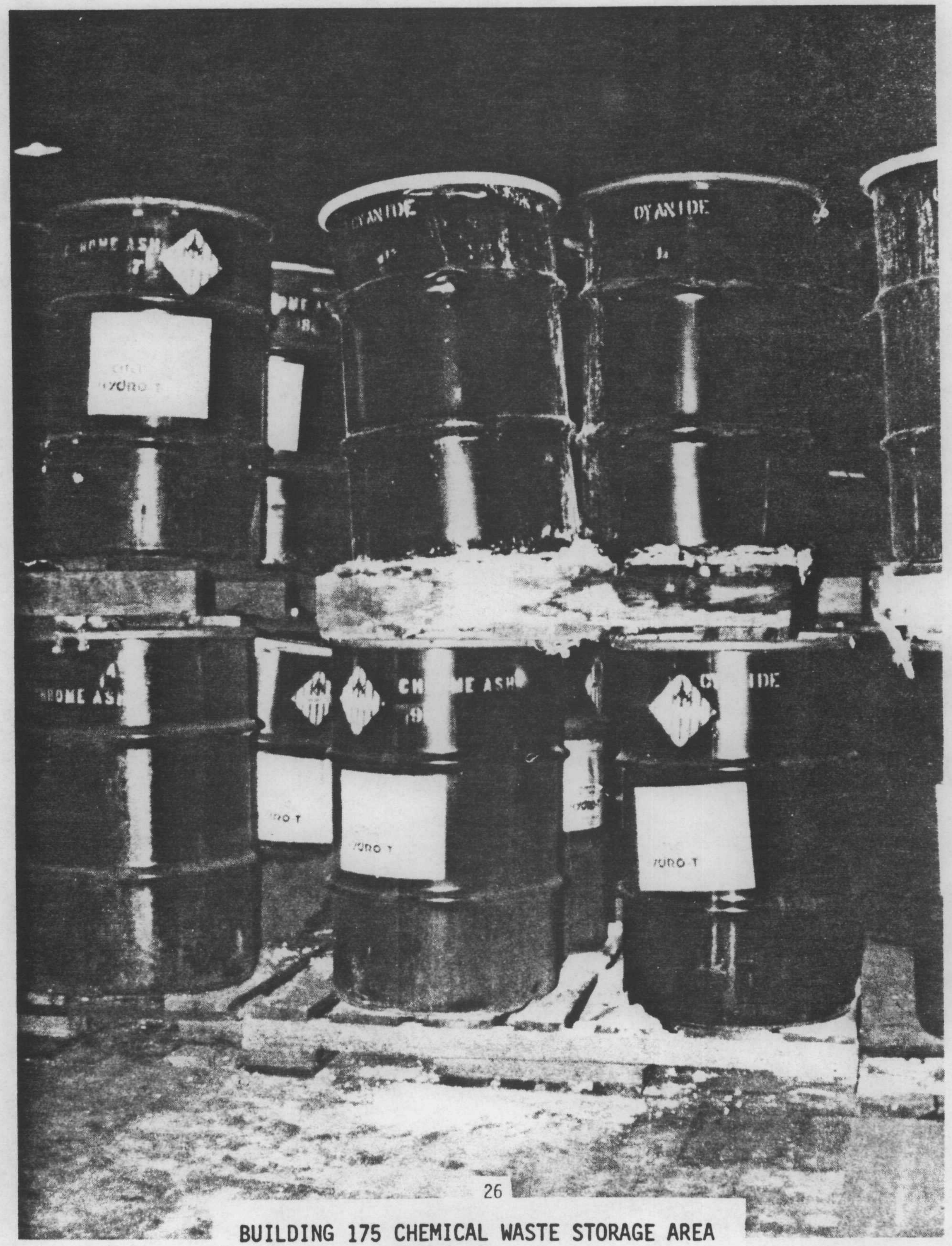
OLD LANDFILL AREA LOOKING SOUTH

23


BUILDING 175 CHEMICAL WASTE STORAGE AREA

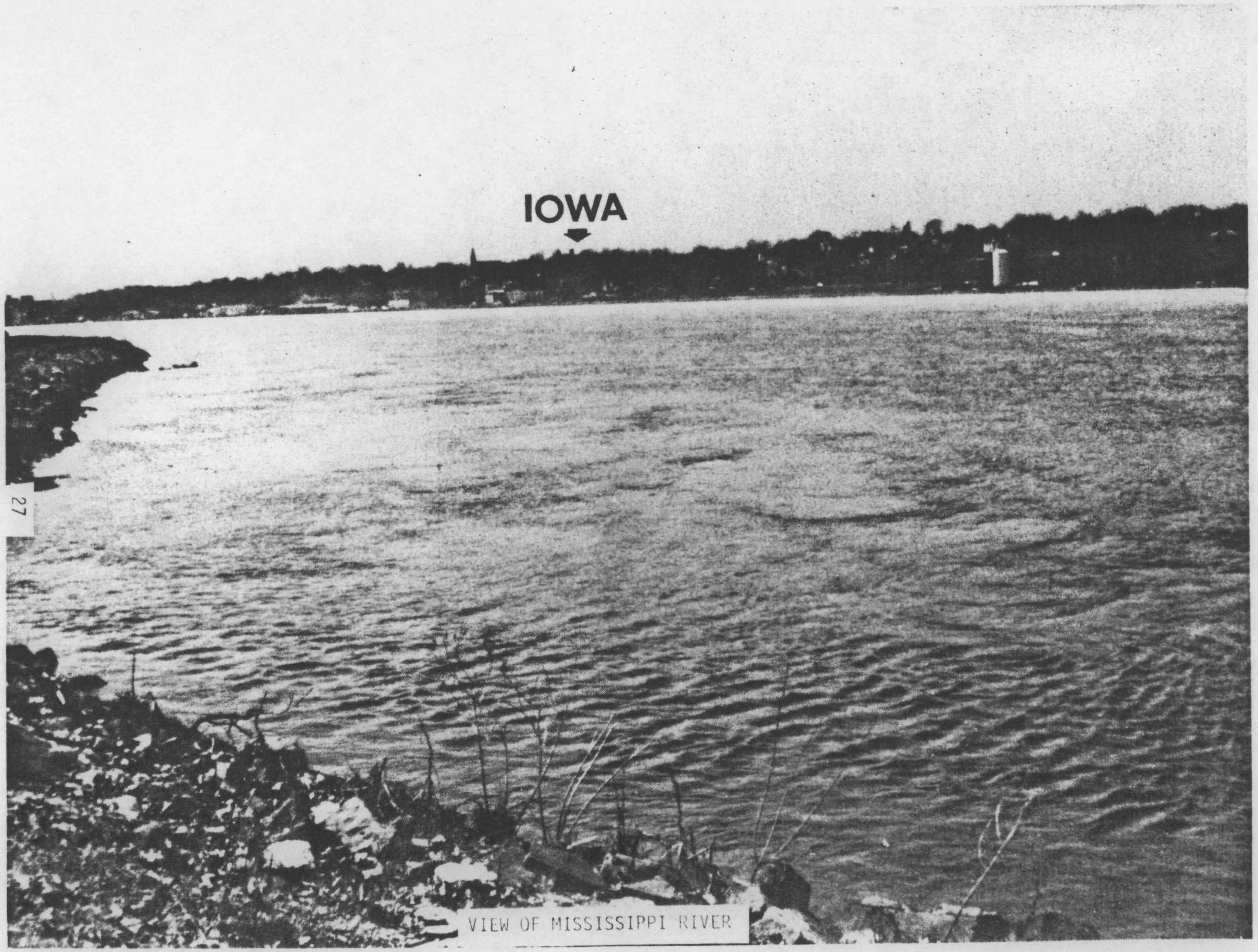


BUILDING 175 CHEMICAL WASTE STORAGE AREA






BUILDING 175 CHEMICAL WASTE STORAGE AREA




VIEW OF MISSISSIPPI RIVER

APPENDIX B

PRINCIPAL NATIVE VEGETATION

PRINCIPAL NATIVE VEGETATION

a. Native Tree Species

| COMMON NAME | SCIENTIFIC NAME |
| --- | --- |
| Silver maple | _Acer saccharinum_ |
| Norway maple | _Acer platenoides_ |
| Sugar maple | _Acer saccharum_ |
| River birch | _Betula nigra_ |
| Shagbark hickory | _Carya ovata_ |
| Hackberry | _Celtis occidentalis_ |
| White ash | _Fraxinus americana_ |
| Honey locust | _Gleditsia triacanthos_ |
| Red cedar | _Juniperus virginiana_ |
| Pine | _Pinus sp_. |
| Black walnut | _Juglans nigra_ |
| American planetree | _Platanus occidentalis_ |
| Cottonwood | _Populus deltoides_ |
| Chokecherry | _Prunus virginiana_ |
| Douglas fir | _Pseadotsaga taxifolia_ |
| Oak | _Quercus sp_. |
| Willow | _Salix sp_. |
| American linden | _Tilia americana_ |

PRINCIPAL NATIVE VEGETATION (Continued)

b. Native Shrub and Vine Species

| COMMON NAME | SCIENTIFIC NAME |
|---|---|
| Serviceberry | *Amelanchier sp.* |
| Wild grape | *Ampelopsis sp.* |
| Bittersweet | *Celastrus scandens* |
| Dogwood | *Cornus sp.* |
| Hazelnut | *Corylus americana* |
| Forsythia | *Forsythia sp.* |
| Witch hazel | *Hamamelis virginiana* |

APPENDIX C

TEST WELL DRILLING,
SANITARY LANDFILL, ROCK ISLAND ARSENAL

SUBSURFACE EXPLORATION DATA
by
WABASH DRILLING COMPANY
110 Angelica St o St. Louis, Mo 63147 o 421-2460

Date of Drilling
Started 10-24-78
Finished 10-24-78

Boring No 1
Coordinates
Surf. Elev.
Gr. Water Elev. 7'0"

Client Harland Bartholomew & Associates
Job Name Rock Island Arsenal  Client's Job No.
Job Location Rodman Avenue & Gellispi Street  City Rock Island  State Ill.
Casing O.D.  I.D.  Sampler O.D. 2"  I.D. 1-3/8
Casing Hammer  lbs.  fall  Sampler Hammer 140 lbs. 30" fall
W. D. Co. Foreman  Client's Inspector

| Depth Below Ground Surface (Meters) | Blows On Casing | Sample Number | Blows On Sampler | Penetration Of Sampler (cm) | FIELD IDENTIFICATION OF SOIL (Include relative firmness, relative moisture, color, mention all soil constituents, etc.) | REMARKS |
|---|---|---|---|---|---|---|
| | | | | | Cinders, wood, metal, limestone boulders & pieces of concrete 1.5 m in diameter | Encountered water @ 2.3 m<br>Set 4.7 m of 10.2 cm PVC Pipe; bottom of pipe is at 3.8 m |
| 1.5 | | 1 | 7-9-5 | 15-15-15 | | |
| 22.9 | | | | | | |
| 2.7 | | 2 | 1-1-1 | 15-15-15 | Wet, soft, gray, clay with some fine sand | |
| 3.2 | | | | | | |
| 3.9 | | | | | Wet, gray, fine, loose sand | Refusal @ 3.9 m |
| | | | | | Total depth of boring 3.9 m | |

SUBSURFACE EXPLORATION DATA
by
WABASH DRILLING COMPANY
110 Angelica St o St. Louis, Mo 63147 o 421-2460

Date of Drilling
Started 10-25-78
Finished 10-25-78

Boring No 2
Coordinates
Surf. Elev.
Gr. Water Elev. 8'0"

Client Harland Bartholomew & Associates
Job Name Rock Island Arsenal Client's Job No.
Job Location Gellispi Street City Rock Island State Ill.

Casing O.D. I.D. Sampler O.D. 2" I.D. 1-3/8
Casing Hammer lbs. fall Sampler Hammer 140 lbs. 30" fall
W. D. Co. Foreman Client's Inspector

| Depth Below Ground Surface (Meters) | Blows On Casing | Sample Number | Blows On Sampler | Penetration Of Sampler (cm) | FIELD IDENTIFICATION OF SOIL (Include relative firmness, relative moisture, color, mention all soil constituents, etc.) | REMARKS |
|---|---|---|---|---|---|---|
| | | | | | Moist, gray, soft clay and cinders with some boulders | Encountered water @ 2.4 m |
| 1.5 | | 1 | 1-1-1 | 15-15-15 | | |
| 2.4 | | | | | | Set 6.1 m of 10 cm PVC Pipe; bottom of pipe is @ 5.5 m |
| 0 | | 2 | 3-4-5 | 15-15-15 | Wet, gray, loose, fine sand | |
| 0.8 | | | | | | |
| 4.6 | | 3 | 4-5-8 | 15-15-15 | Wet, gray, medium dense, fine sand with some gravel | Refusal @ 5.8 m |
| 5.8 | | | | | Total depth of boring 5.8 m | |

SUBSURFACE EXPLORATION DATA
by
WABASH DRILLING COMPANY
110 Angelica St o St. Louis, Mo 63147 o 421-2460

Date of Drilling
Started 10-24-78
Finished 10-24-78

Boring No 3
Coordinates
Surf. Elev.
Gr. Water Elev. 10'0"

Client Harland Bartholomew & Associates
Job Name Rock Island Arsenal Client's Job No.
Job Location Gellispi Street City Rock Island State Ill.
Casing O.D. I.D. Sampler O.D. 2" I.D. 1-3/8
Casing Hammer lbs. fall Sampler Hammer 140 lbs. 30" fall
W. D. Co. Foreman Client's Inspector

| Depth Blow Ground Surface (Meters) | Blows On Casing | Sample Number | Blows On Sampler | Penetration Of Sampler (cm) | FIELD IDENTIFICATION OF SOIL (Include relative firmness, relative moisture, color, mention all soil constituents, etc.) | REMARKS |
|---|---|---|---|---|---|---|
| | | | | | Cinders, wood, metal, limestone boulders and pieces of concrete | |
| 1.5 | | | | | | |
| | | 1 | 4-10-6 | 15-15-15 | | |
| 2.4 | | | | | | |
| | | | | | Wet, gray, soft, plastic, clay with trace of fine sand | Encountered water @ 3.1 m |
| 0 | | | | | | |
| 0.1 | | 2 | 1-2-2 | 15-15-15 | | |
| 4.6 | | | | | Wet to moist, gray, fine, loose to medium dense sand | Set 6.7 m of 10 cm PVC Pipe; bottom of pipe is @ 5.8 m |
| | | 3 | 4-5-6 | 15-15-15 | | |
| 5.5 | | | | | | |
| 6.1 | | | | | Wet, gray, fine, medium dense sand with trace of gravel | |
| | | 4 | 5-6-6 | 15-15-15 | | |
| 7.4 | | | | | Total depth of boring 7.4 m | Refusal @ 7.4 m |

SUBSURFACE EXPLORATION DATA
by
WABASH DRILLING COMPANY
110 Angelica St o St. Louis, Mo 63147 o 421-2460

Boring No 4
Coordinates
Surf. Elev.
Gr. Water Elev.

Date of Drilling
Started 10-25-78
Finished 10-25-78

Client Harland Bartholomew & Associates
Job Name Rock Island Arsenal Client's Job No.
Job Location Gellispi Street City Rock Island State Ill.
Casing O.D. I.D. Sampler O.D. 2" I.D. 1-3/
Casing Hammer lbs. fall Sampler Hammer 140 lbs. 30" fall
W. D. Co. Foreman Client's Inspector

| Depth below Ground Surface (Meters) | Blows On Casing | Sample Number | Blows On Sampler | Penetration Of Sampler (cm) | FIELD IDENTIFICATION OF SOIL (Include relative firmness, relative moisture, color, mention all soil constituents, etc.) | REMARKS |
|---|---|---|---|---|---|---|
| | | | | | Cinders, wood, metal, limestone boulders and pieces of concrete | |
| 3.5 | | | | | | Encountered water @ 3.5 m |
| 4.6 | | | | | Wet, soft, gray clay with some fine sand | |
| | | | | | Wet, gray, medium dense, fine sand with some gravel | |
| 6.35 | | | | | | Refusal @ 6.35 m |
| | | | | | Total depth of boring 6.35 m | |

SUBSURFACE EXPLORATION DATA
by
WABASH DRILLING COMPANY
110 Angelica St o St. Louis, Mo 63147 o 421-2460

Date of Drilling
Started 10-25-78
Finished 10-25-78

Boring No 5
Coordinates
Surf. Elev.
Gr. Water Elev. 8'0"

Client Harland Bartholomew & Associates
Job Name Rock Island Arsenal Client's Job No.
Job Location Gellispi Street City Rock Island State Ill.
Casing O.D. I.D. Sampler O.D. I.D.
Casing Hammer lbs. fall Sampler Hammer lbs. fall
W. D. Co. Foreman Client's Inspector

| Depth Below Ground Surface (Meters) | Blows On Casing | Sample Number | Blows On Sampler | Penetration Of Sampler (cm) | FIELD IDENTIFICATION OF SOIL (Include relative firmness, relative moisture, color, mention all soil constituents, etc.) | REMARKS |
|---|---|---|---|---|---|---|
| | | | | | Cinders, wood, metal, concrete and limestone boulders | Encountered water @ 2.4 m<br>Set 4.3 m of PVC pipe in boring; bottom of pipe @ 3.5 m |
| 2.4 | | | | | Wet, gray, soft, clay with some fine sand | |
| 3.5 | | | | | Total depth of boring 3.5 m | Refusal @ 3.5 m |

# APPENDIX D

Contaminants Generated by

Past and Present Industrial Operations

## CONTAMINANTS GENERATED BY PAST AND PRESENT INDUSTRIAL OPERATIONS

| BLDG | OPERATION | EXPOSURE |
|---|---|---|
| 25 | Cleaning small weapon parts; firing range | Solvents-methyl chloroform; lead, propellants, cyanide residues found in dust (1972); Ethylene glycol; perchloroethylene; methylene chloride, Stoddard-type petroleum hydrocarbons |
| 32 | Hand loading 37-75mm rounds, machining & grinding, cleaning metal parts, welding | M2 double base cannon propellant (nitrocellulose, nitroglycerine, barium nitrate, ethyl centralite, potassium nitrate, graphite), metal dust, Stoddard solvent, flux residue |
| 38 | Cleaning inside boilers, steam pipe insulation analysed - 5% asbestos found | Vanadium pentoxide |
| 46 | Cleaning weapon bore and breech parts | Butyl cellosolve, cresol, unidentified chlorinated hydrocarbon - possibly dichloropentane, mineral spirits, high boiling petroleum hydrocarbon (b.p. 230 degrees C) |
| 50 | Treating post water supply, chemical analyses of post water supply | Aluminum sulfate, lime, copper sulfate, standard laboratory analyses |
| 56 (Storehouse K) | Cleaning, lubricating, degreasing metal parts, applying preservatives, plastic coating | Stanisol solvent, alkaline solutions, oils, trichloroethylene, Stoddard solvent fingerprint remover; Pl, 3, 4, 5, 6, organic preservatives; cellulose acetate butyrate |

| BLDG | OPERATION | EXPOSURE |
|---|---|---|
| 58 | Applying dry film lubricant, vapor degreasers, metal surface treating, abrasive & sandblasting, grinding, parkerizing and chromate treatment of metals, lubricating gears, pickling, derusting, phosphatizing, blackening metal parts, magnaflux inspection | Lubricants, paint residue, toluene, ethanol, methyl ethyl ketone; 1,1,1-trichloroethane; chromic, hydrochloric acids; sodium nitrate, manganese & zinc phosphate, black dye, potassium nitrate, sodium dichromate, Stoddard solvent, sodium fluoride, dioxane, toluene, metallic dusts, alumina, Stanisol solvent, kerosene, cutting and cooling oils, sodium cyanide, trichlorethylene, sodium hydroxide; Phosphoric acid |
| 60 (Shop B) | Firing handguns, overhauling tank motors, repairing carburators, degreasing, decarbonizing, overhauling spark plugs | Lead residue, Bendix cleaner, trichloroethylene, lead dust, ethylene dichloride, pine oil, ethylene dichloride, garnet dust, "Gunk" x-11 (coal tar, cresol) |
| 61 (2-D annex) | Grinding and buffing, spray painting, magnaflux inspection, machining, grinding, vapor degreasing | Metal dusts, paint, solvent residue, kerosene, cutting and coolant oils, trichlorethylene, lead dust |
| 62 (Shop D) | Vapor degreasing, fabricating gun barrels, derusting, abrasive blasting, steam cleaning, castings, welding, calibrating carburators, cleaning engines, silver brazing, salvaging oil from metal shavings, spraying metal parts with preservative oils | Methyl chloroform, coolant, cutting oils, greases, metal dust, trichloroethylene, Stanisol solvent, flux residue, naphtha, mixture of petroleum and chlorinated hydrocarbons and cresylic acid, Stoddard solvent, cadmium residue(from brazing operation); heptane |

| BLDG | OPERATION | EXPOSURE |
|---|---|---|
| 63 (BD court) | Spray painting, engine breakdown, machining, welding, degreasing | Paint, solvent vapor, oils greases, Stoddard solvent, cutting and cooling oils, metal, flux residue, trichloroethylene |
| 64 (Shop F) | Vapor degreasers, metal surface treatment, cyanide destruct room, chromium plating and stripping, anodizing, cadmium, tin, copper, zinc, nickel, lead plating; electro-polishing; "Lubrite" surface treating, magnaflux inspection; etching metal parts, dying aluminum parts, pickling metal parts, paint stripping, derusting, tinning and galvanizing metal parts, dipping metal parts in preservative oils, epoxy-coating, Perkerizing metal parts, chromium, copper, cadmium, zinc, nickel stripping | 1,1,1-trichloroethane, chromic acid, phosphoric and sulfuric acid, alkali cleaner, hydrofluoric acid, dichromate solution, iridite-chromate conversion coating, deoxidizer, cadmium cyanide, brass and copper bright dip, cyanide waste residue, oil, metal dust, Stoddard solvent, kerosene, pyrophosphates, metal plating solutions, trichloroethylene, acetic acid, manganese carbonate, kerosene, hydrochloric acid, nickel acetate, aluminum dyes, tin and lead fluoroborate, copper sulfate copper cyanide, nickel salts, tin, zinc, lead dusts, Light preservative oils, sodium, potassium and zinc oxide; nitric acid ammonium fluoride, acetone, fluoroboric acid |
| 65 (Boiler house F) | Industrial waste treatment plant, welding, silver soldering (infrequent); spray painting, machining and grainding, reclaiming chromic acid | List of chemicals stored (1976) given in App. F, USAEHA Report #35-0566-77; metal and flux residue, paint, thinner residue, chromic and sulfuric acids |
| 66 (Shop H) | Honing, grinding, heat-treating metal parts, brazing, filling and charging Edison batteries, cleaning metal parts, silver-soldering, abrasive blasting, | Cutting and coolant oils, metal dust, sodium cyanide, chloride and decomposition products, oil, flux residue, potassium hydroxide solution, Stoddard solvent, greases, phosphoric acid chromic acid, flux residue |

| BLDG | OPERATION | EXPOSURE |
|---|---|---|
| 66 (con't) | machining, Parkerizing lubricating, heat treating metal, quenching metal, plastic-coating metal parts, magnaflux inspection, welding, plating, bright dipping | cutting oils and lubricants, rubber-base plastic, barium chloride, kerosene; acidic water solution of phosphate and nitrate, iron, manganese, sodium present; benzol, chromic acid |
| 67 (H-K annex) | Refinish/rework gun stocks, spray painting | Solvent residue, epoxy glues and resins, paint dust |
| 68 (Shop K) | Chemical storage area (basement, south end), relining asbestos block furnace interiors, vapor degreasing, magnaflux inspection, welding, grinding, replensihing acid solution, machining, cleaning small arms, dip-coating metal parts, proof firing | Nitric and chromic acids, bases, oxidizers, volatile materials; phosphoric and hydrochloric acid, Oakite Cryscoat OC (8% zinc dihydrogen phosphate, 5% nitric acid), oil, Oakite Black Guard (30% sulfuric acid, 19% hydrochloric acid), 2:1 sodium hydroxide-sodium nitrite solution, Oakite LRS cleaner, Du-Lite Black Oxide, sodium carbonate, zinc oxide, 1,1,1-trichloroethane, rust preventative (5% butyl cellosolve); asbestos dust, kerosene, metal and flux residue, cutting and coolant oils, trichloroethylene, Stanisol solvent, Stoddard solvent, lubricating and preservative oils and greases, lead dust, sodium hydroxide, potassium nitrate, oils, greases |
| 69 (Shop H Court) | Metal surface treating, chromium plating, bright dipping, brush lacquering, grinding, polishing metal, pickling, parkerizing, vapor degreasing | Chromic acid, zinc phosphate and chloride, caustic, solvent residue, metal dust, phosphoric acid, 1,1, 1 trichloroethane, trichloroethylene, cyanide salts, arsenic residue, zinc chloride, lead dust, copper, cadmium |

| BLDG | OPERATION | EXPOSURE |
|---|---|---|
| 72 (H-K court) | Function firing range, metal cleaning and preserving, packaging metal parts, vapor degreasing | Lead residue, methyl chloroform, some cyanide contamination found in dust (1972), Stoddard solvent, fingerprint remover; P-1, 2, 3, 6, 7, 9, and 19 petroleum hydrocarbon preservative compounds, VCI paper, trichloroethylene, wax |
| 102 (Shop A) | Oil and plating laboratories-chemical analyses; metal surface treatment, pipe fitting shop-removing and replacing asbestos insulation; metalizing operation; vapor degreasing, silver soldering, cleaning and filling refrigeration systems, cleaning electrical contacts, grinding, vapor degreasing, radiochemistry lab; chrome-plating; nickel, zinc, cadmium, brass, copper-strike plating, anodizing brass, aluminum; Parkerizing metal parts, stripping plating from metal parts, derusting, cleaning metal parts, vapor pressure determinations, battery charging | Standard laboratory chemicals (AEHA Report 35-0566-77), chromic acid, magnesium phosphate, caustic, asbestos dust, metal residue - including cadmium, molybdenium, tungsten, zinc, aluminum, titanium, silver, nickel; methyl chloroform; copper solutions; caustic sodium nitrate solution, sulfuric acid, flux residue, freon 12 & 22, oils, greases, Stoddard solvent, ethyl alcohol and detergent, trichloroethylene, various cyanide solutions including nickel, sodium, copper and zinc, radioisotopes, acetic acid, phosphoric acid, zinc dihydrogen phosphate, potassium pyrophosphate, sodium orthosilicate, nickel chloride and sulfate, copper sulfate, sulfamic nickel, mercury (inclosed operation), carbon tetrachloride, caustic, sodium orthosilacate |
| 103 (Lab; A-C annex) | Chemical analyses of petroleum products, grinding metal parts, plasma torch spraying, spray painting, cleaning metal parts, de- | Standard lab reagents, oils, greases, metal dust, fulx residue, paint solvent residue, benzene, toluene, acetone, naptha, Stanisol solvent; trichloroethylene, cellulose |

| BLDG | OPERATION | EXPOSURE |
|---|---|---|
| 103 (con't) | greasing, preserving, testing compounds for protection against corrosion, machining, experimental chrome plating, metallographic analyses, plastic coating | acetate butyrate, ethyl cellosolve, cutting and coolant oils, gasoline, other fuels, tetraethyl lead, naphtha, methanol, xylene, petroleum hydrocarbons, chromic acid, Stoddard solvent |
| 104 (Shop C) | Performing lab experiments, cementing rubber and canvas, gluing formica to wood, machining and grinding | Lab chemicals, ethylene dichloride; Formica brand adhesive 140; toluene, methyl ethyl ketone, iso-octanes, oils, greases, metal dust, impregnated canvas - cyclohexane, para-nitrophenol, 1, 1, 1-trichloroethane |
| 106 (Shop E) | Oxy-acetylene and air-arc cutting and washing, cutting and grinding, arc welding, fabricating items from canvas (treated), cleaning canvas and leather items, melting bronze, copper, aluminum-bronze, aluminum-magnesium, molding, abrasive blasting | Flux residue, fluorides, oil, kerosene, phosphorus, metal dust, including lead, aluminum, copper, brass, bronze, magnesium, tin, iron, steel and zinc; canvas impregnated with copper 8 quinolinolate, methyl chlorogorm, magnesium oxide, silica, Bentonite, corn flour |
| 107 (Lab, A-C Court) | Vapor degreasers, chemical analyses, petroleum products storage, heat-treating metals, machining and grinding, metallurgical lab, developing and printing photographs, welding | 1,1,1-trichloroethane; standard laboratory chemicals (AEHA Report 35-0566-77), trichloroethylene, metal dust, hydrochloric acid, Stoddard solvent, standard photographic chemicals, trichloroethylene, flux residues, cutting oils and coolants |

| BLDG | OPERATION | EXPOSURE |
|---|---|---|
| 108 (Shop G) | Photoprocessing (black and white and color), hot glue-bookbinding, machining and grinding, cleaning metal parts, operating offset presses, copy camera (carbon arc), melting and pouring lead, blueprint machines, ditto machines, photostat machine, brush painting (infrequent), xerography | Photographic chemical residues, amines, vinyl materials, natural resins, metal dusts, cutting and coolant oils, Stoddard solvent, perchloroethylene flux residue, various inks, Blankrola (perchloroethylene and petroleum hydrocarbons), lead residue, potassium hydrosulfite, methanol, ethanol, ammonium thiosulfate, acetic acid, 3M brand type R image developer-contains ethyl butyl ketone, paint and thinner residue, thermo-plastic dust, methyl chloroform |
| 109 (G-I annex) | Welding, cutting silver brazing, metal surface treating, machining and grinding metal parts, painting, soldering, cleaning, coating, plating metal parts, charging batteries, stenciling, degreasing, heat treating, abrasive blasting | Flux and metal residue (including cadmium) Oakite deoxidizer (aluminum), paint thinner residue, sulfuric acid, thrichloroethylene, caustic, sodium nitrate |
| 110 (Shop I) | Rubber, radiochemistry & fibrous materials laboratories-chemical analyses; storage of chemicals (in basement), spray painting, vapor degreasing, application of strippable coatings and wax to small items, operation of spectrographs, welding, test-firing 50 cal machine guns, developing spectrographic film, analyses of substances with a | Standard leaboratory chemicals (AEHA Report 35-0566-77), including epoxy and rubber resins and catalytic and curing agents, paint, thinner residue, chromic, sulfuric, phosphoric, hydrochloric, hydrofluoric, nitric acids, methyl chloroform, trichloroethylene, metal residues, Stoddard solvent, lead residue, rubber dust, standard photographic chemicals, Stanisol solvent, oils, waxes, greases, naphtha, hydrogen sulfide, |

| BLDG | OPERATION | EXPOSURE |
|---|---|---|
| 110 (con't) | relatively low order of radioactivity, machining, grinding, pouring dummy projectiles, parkerizing | bases, nickel carbonyl, unspecified radioactive substances, fluorides, cellulose acetate butyrate, tetrachloroethylene, lead dust |
| 112 | Prototype weapons assembly, solvent cleaning, spray painting | Stoddard-type solvents, lubricants, paint and solvent residue, including zinc chromate, oils, greases |
| 120 | Acid storage | Acids, alkalis-hydrochloric, nitric, sulfuric, fluoboric, phosphoric, hydrofluoric, chromic acids |
| 125 | Spray painting, treating leather and canvas, paint stripping | Paint thinner residue, Stanisol solvent, copper naphthanate, paranitrophenol, trichloroethylene, cyclohexanone, aromatic hydrocarbon solvent |
| 131 (Storehouse A) | Mold pouring, applying preservative coatings, cleaning metal parts, arc & drill engraving, ultrasonic cleaning, sealing gages | Analysis of alloy-tin, indium cadmium, bismuth, lead; cellulose acetate butyrate, thinner, Stoddard solvent, metal dust, detergent residue, sealing wax, F.O. Safe-tee solvent (methylene chloride, perchloroethylene, petroleum hydrocarbons) |
| 132 (Storehouse AA) | Spray painting | Paint, thinner residue |
| 139 | Spray, brush painting, relining furnaces with asbestos block, storing and mixing pesticides, respirator maintenance area, | Paint, solvent residue, asbestos dust, cleaning and repair of respirators--potential pesticide, chemical dust, cadmium, silver, lead, zinc, tin, (analysis of alloys used |

| BLDG | OPERATION | EXPOSURE |
|---|---|---|
| 139 (con't) | welding, brazing, insulation on pipes (analyses-contained asbestos), grinding metal parts, cleaning metal parts and paint brushes, cutting pipe and metal | in brazing), lacquer thinner, metal dust, flux residue, oils, greases; lindane, malathion, nicotine sulfate, allethrin, sodium fluoride, pyrethrum, calcium cyanide, strychnine sulfate, DDT, lime sulfur, dieldrin |
| 143 | Underground maintenance of fuel and solvent tanks | P-D-680 cleaning solvent, oils, lubricants |
| 144 | Bulk storage area, filling and dispensing solvent containers | Acids, alkalis, oils, lubricants, paints, benzene, toluene, methanol, methyl chloroform, petroleum, naphtha, methylene chloride |
| 145 | Spray painting, mildew and fungus-proofing canvas, sanding metal (painted), grinding metal | Paint, thinner residue, copper-8-quinozinlate, metal dust, glass, plastic dust, cyclohexanone, paranitrophenol, 1,1,1-trichloroethane, cyclohexane, copper naphthenate, Stoddard solvent, oil, trichloroethylene |
| 154 (Storehouse G) | Silver recovery | Cyanide, silver residue |
| 157 (Storehouse I) | Repairing office machines, brazing | Metal (including cadmium) and flux residue |
| 159 | Testing, tuning engines, steam cleaning, radiator filling, welding, brake relining, occasional filling and charging batteries, cleaning | Oils, greases, caustic, methyl chloroform, Stoddard solvent, Stanisol, copper, iron, zinc, silver, cadmium, fluorides residues, asbestos dust, trace ($<$0.1%) lead, sulfuric acid, solvent |

| BLDG | OPERATION | EXPOSURE |
|---|---|---|
| 159 (con't) | carburators, bonding brake shoes, silver soldering (infrequent), soldering, spray painting vehicles, machining and grinding, welding | mixture containing petroleum and chlorinated hydrocarbons and cresylic acid, various adhesives, flux residues, kerosene, organic solvent (Magnus), detergent residue, cutting oils, coolants, metal dust |
| 168 | Conditioning boiler water, testing boiler water, cleaning parts, painting, stripping asbestos from pipes | Sodium hexametaphosphate, tannin, sodium sulfate, caustic soda, standard laboratory reagents, Stoddard solvent, paint pigments, thinner vapors, asbestos dust |
| 205 | Photo laboratory, offset printing presses, ozalid reproduction machines, xerox M4 copy machine | Standard photographic chemicals inks, Blankarola (perchloroethylene, petroleum hydrocarbons), 3M Brand type R image developer (water, residue, ethyl butyl ketone), trichloroethylene |
| 208 | Spray painting, welding, silver-brazing, metal surface treatment-paint stripping, removing insulation from steam pipes, degreasing, abrasive blasting, testing engines, grinding brake linings, conditioning metal parts, honing cylinders, grinding valves, emptying dust collectors, steam cleaning, magnaflux inspection, silver soldering, soldering, sealing gaskets, | Paint residue, solvents, fluorides metal dusts (Inc. copper, zinc, chromium, cadmium), methylene chloride, cold stripper #117, methyl chloroform, oil, greases, flux residue, asbestos dust, phosphoric acid, cutting and coolant oils, detergents, kerosene, Stoddard solvent, hydraulic fluids, Gunk Hydroseal (chromates and emulsifier, plus methylene chloride, chloroform, trichloroethylene dichlorobenzene, phenol, cresols) 3M brand EC847 sealant, alkali, P-1 organic preservative, heptane, |

| BLDG | OPERATION | EXPOSURE |
|---|---|---|
| 220 (con't) | batteries, flame-proofing uniforms, sealing pipe joints, spray-priming metal parts, plastics fabrication, sand-blasting, abrasive blasting, milling and compounding synthetic rubbers, vlucanizing rubber, injection molding of thermal plastics curing plastic de-flashing rubber, heat treating metal parts, magnaflux inspection, cleaning recoil mechanisms, spraying plastic coating, mixing fiber-glass, oil quenching metal parts, metall-izing, case hardening, insect and rodent control (basement)-mixing and dispersing insect-icides and rodenticides | dust, Chesteron Spray Solvo (high-boiling oils, lower boiling petroleum hydro-carbons, green coloring agent), methyl ethyl ketone, naphtha, benzene, acetone, tetrahydro-furan, cyclohexanone, Stoddard solvent, cutting oils, sulfur, rubber dust, zinc oxide, rubber adhesives, plastic residue, epoxy resins, aluminum oxide dust, sodium and potassium cyanides, sodium nitrate, trichloro-ethylene, polyvinyl chloride, plastic lead seal no. 2 (lead and sec butyl alcohol), Derusto (chromates, xylene and petroleum hydrocarbons), kerosene, barium chloride, sodium carbonate, methylene chloride, petroleum hydro-carbons mixture, rubber base plastics, DDT, chlordane, dieldrin, malathion, warfarin |
| 222 | Heat-treating metals, vapor degreasers, forging, relining as-bestos block furnace interiors, grinding metal parts, zyglo inspec-tion; spraying metal parts with Spotcheck developer, type SKD-NF | 1,1,1-trichloroethane, asbes-tos dust, Stoddard solvent, isopropanol, mineral spirits, polyethylene/polypropylene glycol polymers, sodium carbonate; zyglo penetrant, ZL-22; sodium cyanide, metal dust, barium chloride |
| 227 | Boiler plant; lab anal-yses; grinding, cleaning metal parts; welding (infrequent), painting | Caustic, tannin, sodium lignosulfate, coal, lime, soda ash, disodium phosphate dusts, possibly vanadium pentoxide dust, small |

| BLDG | OPERATION | EXPOSURE |
|---|---|---|
| 208 (con't) | disassembling tanks and artillery, spray undercoating combat vehicles, spraying strippable adhesive coatings | fingerprint remover (petroleum hydrocarbons), methyl ethyl ketone |
| 210 (Shop R) | Machining, grinding and cleaning metal parts, welding, spray-painting, fabricating aluminum parts, wire-brushing, disc-sanding, sealing castings by impregnation | Cutting and coolant oils, metal and abrasive dust, Stoddard solvent, flux residue, zinc chromate primer, epoxy resins, acetone, Stanisol solvent, metal oxide dust, carbon tetrachloride |
| 216 | Waste oil recovery area and underground oil storage pits | Various oils |
| 217 | Repair of wheeled vehicles, paint and corrosion lab, spray painting, sandblasting, welding, machining, and grinding | POL; paint, thinner residue; metal, flux residue |
| 220 (Shop M) | Vapor degreasers, honing, milling, grinding machines, tool manufacture-welding, investment casting, spring making, relining asbestos block furnace interiors, mixing x-ray film developing chemicals, fabricating antifriction collars, spray painting, silver soldering brazing, charging | Carbon tetrachloride, 1,1,1-trichloroethane, fluorides, cooling lubricant, sharp metal waste, solvent residue, metal, flux, residue, cleaning solvent (Stanisol), wax residue, cadmium oxide residue, asbestos dust, acids, other developing chemicals. Lead, tin, antimony, cooper, zinc, cadmium cust, oil, paint, thinner residue, lead residue, sulfuric and phosphoric acid, potassium hydroxide, flame retardant |

| BLDG | OPERATION | EXPOSURE |
|---|---|---|
| 227 (con't) | | quantities of standard laboratory reagents, Stoddard solvent, paint, solvent residue |
| 230 | Welding, metalizing, vapor degreasers, metal surface treatment, spray painting, abrasive blasting, grinding metal parts, plasma arc cutting torch, magnafluxing | Fluorides, metal residue, (including cadmium, tin, zinc, copper, aluminum), 1,1,1-trichloroethane, aluminum deoxidier, Oakite cleaner, lacquer and solvent residue (isopropanol, isoamyl alcohol, ethyl acetate, isobutyl alcohol, toluene, ethyl benzene, cyclohexanone, ethyl cellosolve, aliphatic hydrocarbons), flux residue, iron oxide, aluminum oxide, paint, solvent residue, perchloroethylene, trichloroethylene, methylene chloride, petroleum hydrocarbons, zinc chromate |
| 235 | Spraying insulating compound onto tank engines, servicing tanks, draining oil and gasoline from tank engines, acetylene cutting | Cellulose nitrate, lacquer thinner (toluene, xylene, petroleum hydrocarbons), oil and grease, metal and flux residue |
| 240 (Shop O) | Vapor degreasing, welding, maching and grinding metal parts, heat treating, cleaning metal parts, forging, spray painting | Methyl chloroform, metal dust, oils, greases, Stoddard solvent, trichloroethylene, alkali, paint, thinner residue, coolant and cutting oils |
| 250 (Shop L) | Solvent cleaning, vapor degreasing, facing, boring metal parts, staining metal parts, magnaflux inspection, boring cylinders, painting fire extinquishers (infrequent), filling fire extinquishers, degreasing, heat-treating, maching | Stanisol solvent, methyl chloroform, metal dust, cutting and cooling oils, Stoddard solvent, trichloroethylene, Dy Kem Layout Red DX 296 (red dye, ethyl alcohol, n-butyl acetate, amyl acetate and unidentified alcohols and/or acetates), kerosene, oils, greases, paint, thinner residue, carbon tetrachloride, sodium and potassium cyanide, sodium carbonate |

| BLDG | OPERATION | EXPOSURE |
|---|---|---|
| 251 (Shop L Annex) | Filling and charging batteries, repairing equipment, soldering, cleaning metal parts, steam-cleaning parts, welding, machining, grinding | Sulfuric acid, potassium hydroxide, oils, greases, metal, flux residue, Stoddard Solvent, methyl chloroform, detergent, alkaline residue |
| 299 (Warehouse) | Vapor degreasers, metal surface treating, spray painting and stenciling, packaging items, cleaning reproduction equipment, charging batteries, abrasive blasting, grinding, soldering, sealing packaged parts, cleaning and preserving metal parts phosphatizing metal parts, derusting, plastic coating of parts, obliterating stencils | 1,1,1-trichloroethane, chromic acid, phosphate solution, alkaline rust remover, paint, thinner residue, VCI paper, trichloroethylene, ditto fluid (methyl and ethyl alcohol), acid, alkaline residues, metal dust, flux residue 3M EC 847 sealant (unknown residue and acetone solvent), Stoddard solvent, fingerprint remover (unknown residue and petroleum hydrocarbon solvent), P 1,2,3,4,5,6,7,9, 10 petroleum hydrocarbon preservatives, phosphoric acid, rust inhibiting paint (spray-lead chromate, xylent, petroleum solvent, and unidentified constituents), oils, grease, Stanisol solvent, cellulose acetate butyrate, lacquer, sodium cyanide, rust preventative AXS-673-mineral spirits and lead soap wax, Cosmoline, lacqer thinner |
| 338 | Spray painting, sanding painted surfaces, welding, packaging metal parts, grinding, cleaning metal parts, stenciling | Paint, thinner residue, metal dust, flux residue, VPI paper, Stoddard solvent |

| BLDG | OPERATION | EXPOSURE |
|---|---|---|
| 350 (Storehouse W-1) | Maintenance of batteries, spray painting, ultrasonic cleaning, cleaning optical equipment, sealing metal parts, coating and decoating lenses, soldering, grinding metal parts, hand-sanding painted parts, preparing chemical solutions, brush painting, cleaning and preserving metal parts, silver brazing, welding | Sulfuric and nitric acid residue, paint, thimmer residue, detergent, methyl chloroform, acetone, ethyl alcohol, Stoddard solvent, Epoxy resins, magnesium fluoride dust, caustic, paint, thinner residue, oils, waxes, Stanisol solvent, trichloroethylene, lacquer, metal and flux residue |
| 351 | Welding, silver brazing cleaning engine parts, lubrication, steam cleaning, spray painting, charging batteries, machining and grinding | Metal, flux residue, braze alloy analysis-trace (<0.1%) cadmium, silver, lead, tin (<2.0%), Stanisol solvent, oil, grease, detergent residue, paint, thinner residue, sulfuric acid, cutting and coolant oils, Stoddard solvent alkali |
| 390 | Spray cleaning typewriters, repairing typewriters, soldering | Stoddard solvent, oil, rubber dust, methyl chloroform, ethyl alcohol, metal and flux residue, Stanisol solvent, Magnasoe (kerosene, petroleum hydrocarbons, water, residue) |
| Post Garage #2 | Steam cleaning, spray painting | Alkali, paint, thinner residue |

# APPENDIX E

# INVENTORY OF POLYCHLORINATED BIPHENYLS

INVENTORY OF POLYCHLORINATED BIPHENYLS (PCB's)
16 January 1979

| Container | Quantity | Condition of Container | Location | Potential Hazard in Case of Spill |
|---|---|---|---|---|
| Capacitor Banks | 24 Units<br>1 1/2 Gal. Each<br>468 lbs. | Good | Building 208 Substation | No floor drains close by. |
| Capacitor Banks | 8 Units<br>1 1/2 Gal. Each<br>156 lbs. | Good | Building 210 Substation | No floor drains in area. |
| Transformer | 181 Gal.<br>2,300 lbs.<br>127 Gal.<br>1,620 lbs. | Good | Building 350 - 1st Floor Northeast Substation | No floor drains. |
| Capacitor | 24 Each<br>1 1/2 Gal.<br>468 lbs. | Good | Building 350 - 4th Floor Substation | No floor drains in area. |
| Transformer | 150 Gal.<br>1,950 lbs. | Good | Building 350 - 1st Floor Middle Rm. | No floor drains in area. |
| Transformer | 241 Gal.<br>3,130 lbs. | Good | Building 350 - 3rd Floor Equipment Rm. | No floor drains in area. |
| Transformer | 148 Gal.<br>1,925 lbs. | Good | Building 350 - 3rd Floor Equipment Rm. | No floor drains in area. |
| Transformer | 249 Gal.<br>3,237 lbs. | Good | Building 208 East Substation | No floor drains in area. |

INVENTORY OF POLYCHLORINATED BIPHENYLS (PCB's) (Continued)

| Container | Quantity | Condition of Container | Location | Potential Hazard in Case of Spill |
|---|---|---|---|---|
| Transformer | 249 Gal.<br>3,237 lbs. | Good | Building 208 West Substation | No floor drains in area. |
| Transformer | 3 Each 70 Gal.<br>2,850 lbs. | Good | Building 68 - Base. West Wing Substation | 4" curb around sub-station. |
| Transformer | 3 each 49 Gal.<br>1,911 lbs. | Good | Building 103 Basement Substation | No floor drains in area. |
| Capacitor Banks | 24 Containers<br>1 1/2 Gal. Each<br>468 lbs. | Good | Building 250 Basement Substation | No floor drains in area. |
| Capacitor Banks | 72 Containers<br>1 1/2 Gal. Each<br>1,248 lbs. | | Building 160 | No floor drains, but could run in river. |
| Transformer | 3 Each<br>75 Gal.<br>Estimated<br>975 lbs. | Good | Building 299 East Substation | 4" curb around sub-station. |
| Transformer | 3 Each<br>75 Gal.<br>Estimated<br>975 lbs. | Good | Building 299 West Substation | 4" curb around sub-station. |
| Transformer | 430 Gal.<br>5,590 lbs. | Good | Building 299 East Substation | 4" curb around substation. |

INVENTORY OF POLYCHLORINATED BIPHENYLS (PCB's) (Continued)

| Container | Quantity | Condition of Container | Location | Potential Hazard in Case of Spill |
|---|---|---|---|---|
| Transformer | 3 Each 75 Gal. Estimated 975 lbs. | Good | On pole rack Building 338 | Leak on ground. |

APPENDIX F

SUMMARY OF PESTICIDE USAGE AT ROCK ISLAND ARSENAL FOR TWELVE CONSECUTIVE MONTHS

SUMMARY OF PESTICIDE USAGE AT ROCK ISLAND ARSENAL FOR TWELVE CONSECUTIVE MONTHS*

A.

| PESTICIDE | AMOUNT OF CONCENTRATE USED | APPLICATION |
|---|---|---|
| Anticoagulant | 0.0023 kilogram | Rodents |
| Baygon | 2.47 liters<br>1.27 kilograms | Roaches |
| Chlordane | 2.43 liters | Termites, mites, ticks, beetles |
| Dursban | 2.13 liters | Spiders |
| Malathion | 874 liters | Mosquitoes |
| Pyrethrum | 0.11 liter | Wasps, ants, mosquitoes |
| Ansenicory | 22.8 liters | Weeds |
| 2,4-d | 43.32 liters | Herbaceous and woody weeds |

B.

| PESTICIDE | DILUTED AMOUNTS USED ANNUALLY | APPLICATION |
|---|---|---|
| Benomyl | 10,242 liters | Weeds |
| Bensulide | 1,520 liters<br>2,160 kilograms | Weeds |
| Thlram | 2,850 liters | Weeds |
| Owaactidione | 6,840 liters | Weeds |
| Owadaconil | 3,610 liters | Weeds |
| Maneb | 3,040 liters | Weeds |
| Ofteran | 1,520 liters | Weeds |
| Bromacil | 855 liters | Weeds |
| Ouncfl 125 | 190 liters | Weeds |

*Summary includes both Rock Island Arsenal and golf course areas.

# APPENDIX G

## Specification for Collection and Disposal of Inert Refuse

Copies of this document may be obtained by contacting: Commander, Rock Island Arsenal, Rock Island, IL 61299.

# APPENDIX H

## Specification for Collection and Disposal of Solid Industrial Waste

Copies of this document may be obtained by contacting: Commander, Rock Island Arsenal, Rock Island, IL 61299.

APPENDIX I

Specification for Disposal of

POL-Type Industrial Waste

Copies of document may be obtained by contacting: Commander, Rock Island Arsenal, Rock Island, IL 61299.

APPENDIX J

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY: APPLICATION FOR PERMIT TO ALLOW THE DISPOSAL OF SPECIAL AND/OR HAZARDOUS WASTE AT AN IEPA PERMITTED DISPOSAL SITE

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY
DIVISION OF LAND/NOISE POLLUTION CONTROL
SPECIAL WASTE DISPOSAL APPLICATION

DATE ________ I P S W C AUTHORIZATION NUMBER ________ TRANS CODE __ DATE ENTERED (Agency Use) __ __ / __ __ / __ __

WASTE HAULER

HAULER REGISTRATION NUMBER ________ NAME ________

ADDRESS ________ COMMUNITY ________

COUNTY ________ STATE ________ ZIP ________ AREA CODE ____ TELEPHONE ________

WASTE GENERATOR

GENERATOR CODE ________ G NAME ________

ADDRESS ________ COMMUNITY ________

COUNTY ________ STATE ________ ZIP ________ AREA CODE ____ TELEPHONE ________

GENERATOR CONTACT NAME ________

DUNS NUMBER ________ SIC CODE ________

PROCESS NAME ________

WASTE CHARACTERISTICS

GENERIC WASTE NAME ________

IUPAC WASTE NAME ________

TOTAL ANNUAL WASTE VOLUME ________ VOLUME UNITS __ WASTE PHASE __

TRANSPORT FREQUENCY __ WASTE CLASS (Agency Use) ____

1 = ONE TIME 5 = MONTHLY
2 = DAILY 6 = BI-MONTHLY
3 = WEEKLY 7 = QUARTERLY
4 = BI-WEEKLY 8 = SEMI-ANNUALLY

VOLUME UNITS:
1 = CUBIC YARDS
2 = GALLONS

WASTE PHASE:
1 = SOLID
2 = SEMI-SOLID
3 = LIQUID
4 = GAS

(Code either "1" for Low, "2" for Medium, or "3" for High as appropriate for columns 21 through 26):

INHALATION TOXICITY __ DERMAL TOXICITY __ INGESTIVE TOXICITY __ INFECTIOUS __ REACTIVITY __ EXPLOSIVE __

FLASH POINT ____ °F ALPHA RADIATION ________ (pCi/L) COMPOSITION __

1 = ORGANIC
2 = INORGANIC

PERCENT ACIDITY ____ PERCENT ALKALINITY ____ pH ____ PERCENT TOTAL SOLIDS ____ PERCENT ASH CONTENT ____

| KEY COMPONENT NAME | PERCENT | KEY COMPONENT NAME | PERCENT |
|---|---|---|---|
| 1 ________ | ____ | 2 ________ | ____ |
| 3 ________ | ____ | 4 ________ | ____ |
| 5 ________ | ____ | 6 ________ | ____ |

DATE ________ I P S E C AUTHORIZATION NUMBER ________ TRANS CODE ___ DATE ENTERED (Agency Use) ___/___/___

WASTE CHARACTERISTICS

| METAL | KEY | TOTAL (PPM) | LEACH (PPM) | METAL | KEY | TOTAL (PPM) | LEACH (PPM) |
|---|---|---|---|---|---|---|---|
| CN | 01 | | | Cu | 02 | | |
| Ag | 03 | | | Hg | 04 | | |
| As | 05 | | | Ni | 06 | | |
| Ba | 07 | | | Pb | 08 | | |
| Cd | 09 | | | Se | 10 | | |
| Cr | 11 | | | Zn | 12 | | |
| | | | | | | | |
| | | | | | | | |

LABORATORY NAME ________________________

CERTIFICATION NUMBER ____________ REVIEWED BY: ___ ___/___ ___

1 SITE CODE ________ SITE NAME ________________
DISPOSAL METHOD ___ NEUTRALIZATION METHOD ___
STATUS ___ START DATE ___/___/___ EXPIRATION DATE ___/___/___
SIGNATURE ________ (SITE OWNER) SIGNATURE ________ (SITE OPERATOR)

2 SITE CODE ________ SITE NAME ________________
DISPOSAL METHOD ___ NEUTRALIZATION METHOD ___
STATUS ___ START DATE ___/___/___ EXPIRATION DATE ___/___/___
SIGNATURE ________ (SITE OWNER) SIGNATURE ________ (SITE OPERATOR)

3 SITE CODE ________ SITE NAME ________________
DISPOSAL METHOD ___ NEUTRALIZATION METHOD ___
STATUS ___ START DATE ___/___/___ EXPIRATION DATE ___/___/___
SIGNATURE ________ (SITE OWNER) SIGNATURE ________ (SITE OPERATOR)

4 SITE CODE ________ SITE NAME ________________
DISPOSAL METHOD ___ NEUTRALIZATION METHOD ___
STATUS ___ START DATE ___/___/___ EXPIRATION DATE ___/___/___
SIGNATURE ________ (SITE OWNER) SIGNATURE ________ (SITE OPERATOR)

5 SITE CODE ________ SITE NAME ________________
DISPOSAL METHOD ___ NEUTRALIZATION METHOD ___
STATUS ___ START DATE ___/___/___ EXPIRATION DATE ___/___/___
SIGNATURE ________ (SITE OWNER) SIGNATURE ________ (SITE OPERATOR)

AGM-1067 (REV. 7/78) (REV. 3/79)

APPENDIX K

Coal Pile Runoff

Project No. D-210-W

WATER POLLUTION STUDY

for

ROCK ISLAND ARSENAL

Rock Island, Illinois

PROJECT NO. D-210-W

COAL PILE RUNOFF

Prepared Under the Direction of

DEPARTMENT OF THE ARMY
Omaha District, Corps of Engineers
Omaha, Nebraska

Prepared by

Harland Bartholomew and Associates
Northbrook, Illinois

Contract No. DACA 45-76-C-0157
Modification No. P00003

23 March 1979



Encl 2'

# WATER POLLUTION STUDY
for
# ROCK ISLAND ARSENAL

Rock Island, Illinois

PROJECT NO. D-210-W

COAL PILE RUNOFF

Prepared Under the Direction of

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Modification No. P00003

23 March 1979

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## INDEX TO FIGURES

# INTRODUCTION

In recent years, the Department of the Army, as well as other Federal agencies, has accelerated its efforts to comply with established pollution control standards at all its facilities. A Presidential Executive Order (No. 12088) signed on October 13, 1978, requires that all necessary actions be taken for the prevention, control and abatement of environmental pollution at facilities under the control of each Executive agency. Prior to this Executive Order, the Department of the Army completed a comprehensive Pollution Abatement Survey at a total of 129 installations including the Rock Island Arsenal. The purpose of this survey was to identify all potential pollution sources not previously recorded and for which no corrective actions or plans had been formulated. One of these possible sources at Rock Island Arsenal included potential water pollution associated with runoff from the coal storage area.

The purpose of this study is to extend the preliminary findings of the identification survey by establishing which applicable pollution control regulations could be violated by runoff from the present facility and to evaluate possible alternative approaches to retention, treatment and/or disposal of coal storage runoff. This study will also include an analysis of the present storage location for possible expansion to meet new supply requirements. The results of this study, together with cost estimates developed for the selected treatment alternative, will be suitable for the preparation of a Project Development Brochure and a DD Form 1391 for future construction programming purposes if required.

## EXISTING CONDITIONS

### General

The primary fuel for heating purposes at the Arsenal is coal. While other methods of heating are used (natural gas, fuel oil and electricity), the present coal-fired central heating plant (Building No. 227) supplies heat to over one half of the heated buildings on the installation and over 85 percent of the total heated volume. The central heating plant serves nearly all of the permanent administrative and industrial buildings within the central built-up area of the Arsenal. All of the family housing quarters along Terrace Drive plus an additional 40 family housing units constructed in 1972 north of Rodman Avenue are heated by natural gas. The Research, Development and Testing Area located at the east end of the island is heated by fuel oil. A few small buildings in scattered locations on the Arsenal are heated by electricity.

The central heating plant is equipped with four coal-fired boilers to produce steam for both heating and industrial purposes. These boilers have a combined nominal generating capacity of 290,000 pounds per hour (see Table 1), which is the estimated normal maximum loading of any one boiler before starting additional boilers to meet steam demands. The combined maximum generating capacity at continuous operation for the four boilers is 330,000 pounds per hour which represents actual capacities considering the age and condition of the equipment, and probably does not meet the original nameplate capacities. The maximum generating capacity with a four-hour limit totals 415,000 pounds per hour. Using a combination of continuous and four-hour operating capacities, the central heating plant is considered to have a maximum generating capacity of 8.26 million pounds of steam in a 24-hour period.

Table 1

Central Heating Plant Boiler Capacities

Rock Island Arsenal, Illinois

| Boiler | Rated H.P. | Nominal Generating Capacity (lbs.per hour) | Maximum Generating Capacity (lbs.per hour) Continuous Operation | Maximum Generating Capacity (lbs. per hour) (Four-Hour Limit) |
|---|---|---|---|---|
| 1 | 1,200 | 70,000 | 80,000 | 100,000 |
| 2 | 1,200 | 70,000 | 80,000 | 100,000 |
| 3 | 1,500 | 85,000 | 100,000 | 125,000 |
| 4 | 960 | 65,000 | 70,000 | 90,000 |
| Total | | 290,000 | 330,000 | 415,000 |

## Coal Procurement

Coal is obtained on an annual contract basis beginning on 1 December and ending on 30 November. Specifications regarding volumes, delivery schedules, gradation, combustion characteristics, and other factors are prepared by the Arsenal based on past experiences and submitted to the Defense Fuel Supply Center for processing and solicitation. Coal specifications for the period 1 December 1978 through 30 November 1979 included the following considerations:

| | |
|---|---|
| Moisture: | 22% max. |
| Ash: | 10% max. |
| Sulphur: | 3% max. |
| Fusing Temperature of Ash: | 2,000 deg. F. |
| BTU/Lb.: | 12,500 |
| Gradation: | Top Size: 1½" max. - 3/4" min.<br>Bottom Size: 0 (Not more than 30% fines passing ¼" screen.) |

Quantity: 40,000 tons

Delivery: 2,000 tons per month from November through February; 4,000 tons per month from March through October.

The delivery schedule outlined in annual procurement requests has almost never been strictly adhered to because of demand, availability and transportation difficulties, particularly during the winter months. Because of this, additional requirements have been imposed to limit the total monthly delivery by any transportation means to 5,000 tons. A maximum of 4,000 tons may be delivered by truck during the months of December through April, providing that quantities do not exceed 250 tons per day. All coal shipped between 1 December and 31 March must receive a freeze-proofing treatment. Approximately 80 percent of all coal delivered to the Arsenal is shipped by rail. The Arsenal has the capacity to unload a maximum of 15 rail cars containing approximately 80 tons each per day. Shipments by truck average between 14 and 17 tons each.

## Coal Consumption

Heat is normally not required when the average outdoor temperature over a 24-hour period is 65 degrees F. or above. For estimating fuel requirements, an analysis of anticipated degree days over a historical period of time is often used. A degree day is defined as a degree declination below 65 degrees F when averaged over a 24-hour period. Therefore, an average outdoor temperature of 30 degrees F amounts to 35 degree days per day. During the past five heating seasons (1 September through 31 May), there has been a wide variance in the total number of degree days illustrating the problems associated with planning future fuel supplies. (See Table 2.) The average number of heating degree days for the past five years (6,515) compares favorably with a twenty-year record (6,474) maintained at a climatological station located in Moline, Illinois.[1]

Table 2

Degree Days Per Heating Season

Rock Island Arsenal, Illinois

| Month | 1973/74 | 1974/75 | 1975/76 | 1976/77 | 1977/78 | 5-Year Average |
|---|---|---|---|---|---|---|
| September | 78 | 180 | 157 | 119 | 50 | 117 |
| October | 258 | 349 | 297 | 578 | 415 | 379 |
| November | 733 | 739 | 586 | 1,037 | 770 | 773 |
| December | 1,274 | 1,122 | 1,072 | 1,393 | 1,338 | 1,240 |
| January | 1,338 | 1,235 | 1,449 | 1,757 | 1,615 | 1,479 |
| February | 1,061 | 1,114 | 851 | 1,072 | 1,416 | 1,103 |
| March | 812 | 1,058 | 731 | 664 | 986 | 850 |
| April | 360 | 593 | 389 | 276 | 423 | 408 |
| May | 235 | 117 | 224 | 69 | 185 | 166 |
| Total | 6,149 | 6,507 | 5,756 | 6,965 | 7,198 | 6,515 |

The consumption rate of coal depends primarily on the demand dictated by the weather versus the demands by industrial activities. (See Figure 1.) Coal consumed to produce steam for industrial purposes during the summer ranges from approximately 1,400 tons per month to 1,600 tons per month. During the heating season, this consumption rate increases substantially to over 7,000 tons during the coldest months. During January, 1977, for example, a total of 8,019 tons of coal was utilized to support on-going industrial activities and a record 1,757 heating degree days.

While the past two winters have been extraordinarily cold, the total amount of coal necessary to support heating requirements have actually

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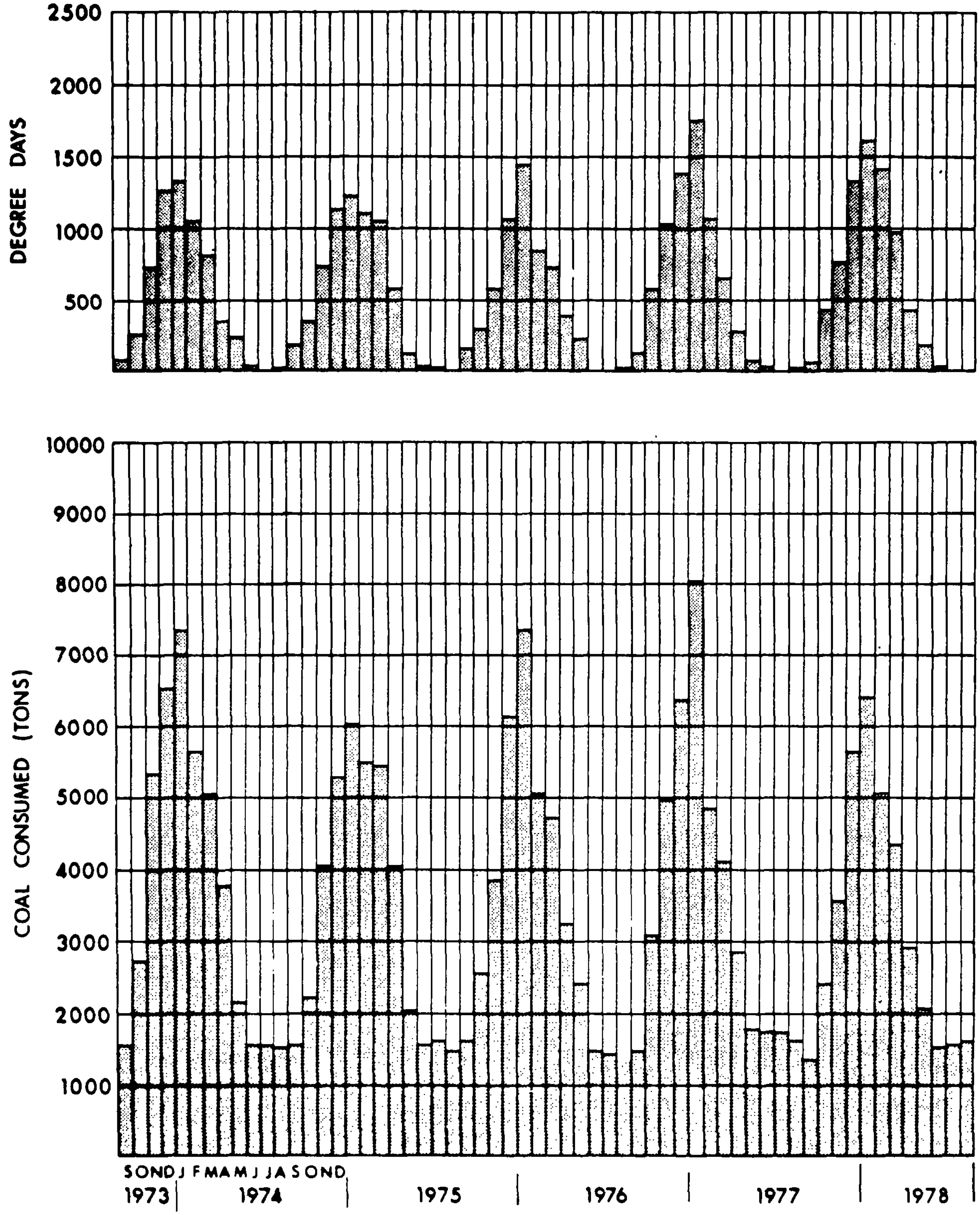
(1) Local Climatological Data, Moline, Illinois, Annual Summary 1977, National Oceanic and Atmospheric Administration.




# CENTRAL HEATING PLANT OPERATION

(SEPTEMBER 1973 THROUGH AUGUST 1978)
ROCK ISLAND ARSENAL, ILLINOIS



FIGURE 1

declined. During the 1973/74 heating season from 1 September through 31 May, a total of 45,540 tons of coal was consumed to support 6,149 degree days. By contrast, the 1977/78 heating season required only 33,640 tons of coal to support a record 7,198 degree days. This can be attributed in part to a slight reduction in heated volume, but is predominantly the result of successful energy conservation measures in recent years. Based on this reduction in fuel consumption, annual coal procurement requests have declined from 51,000 tons in 1973 to 40,000 tons in 1978.

## Coal Storage

Weather permitting, Arsenal operators prefer to feed newly delivered coal directly into the plant in order to eliminate double handling. This is not always possible during severely cold days when some coal arrives frozen in the hopper cars. This continuing problem, plus those periods during the year when deliveries exceed consumption rates, requires that coal be stockpiled.

Current Army requirements concerning coal storage (TM-5-848-3) indicate that storage for space heating should be approximately 20 percent of the anticipated annual consumption. This represents only a 30-day supply. This requirement has been recently revised by DARCOM in a message dated 12 April 1978. In accordance with this message, current recommended coal supply stocks are:

a. 60 day minimum for small requirements in mild climates and close to source of supply.

b. 90 day minimum for the majority of Army facilities.

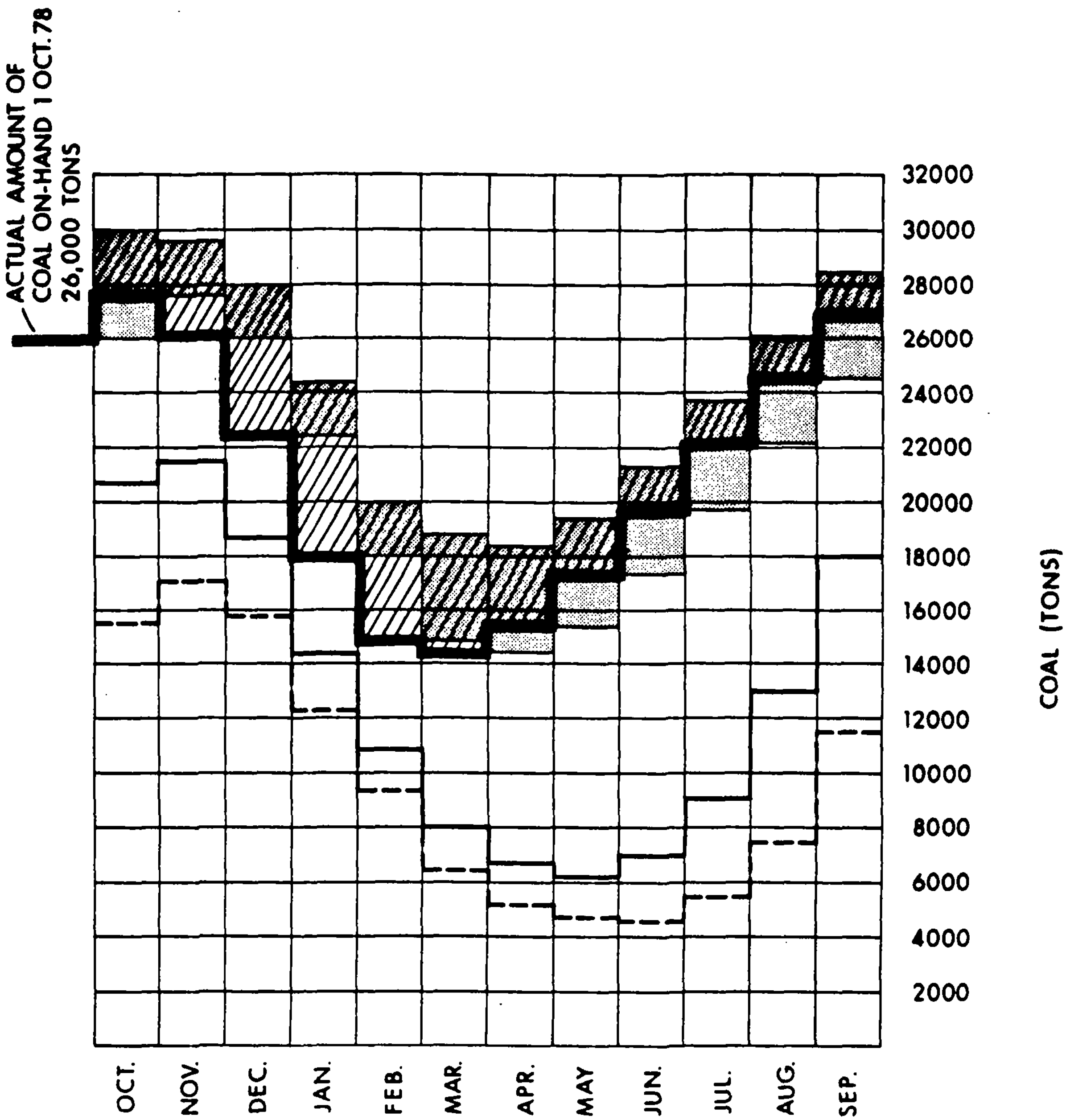
c. 120 day minimum in areas subject to severe weather or remote from sources of supply.

All of the above stockpile categories should be computed at peak monthly consumption rates. Based on the requirements of the recent message, there is some question as to whether the Rock Island Arsenal qualifies for the 120 day storage minimum. Because of this uncertainty, the following discussions regarding storage requirements will include both a 90-day minimum and a 120-day minimum.

Contracted coal deliveries during the severely cold winter months of November through February amount to 2,000 tons per month. This amount is much less than the remaining months of the year when 4,000 tons per month are contracted for delivery. Smaller quantities during the winter months are required because of unloading difficulties. Since this reduction in coal deliveries occurs during the peak consumption periods, it is important to maintain the necessary amount of stockpiled coal to provide the 90/120 day supply through the winter months.

The amount of coal on hand (stockpiled), consumed, and delivered on a yearly basis is illustrated in Figure 2. On 1 October 1978, Arsenal Facilities Engineering personnel estimated the amount of coal stockpiled to be 26,000 tons. This nearly represents the maximum amount that will be stored at the Arsenal for the next 12 months. With a 4,000 ton delivery during October and an anticipated consumption of approximately 2,400 tons, the maximum amount of coal on-hand will be about 27,600 tons. At this time (1 November), consumption rates begin to exceed delivery schedules and the amount of stockpiled coal decreases. (See Figure 2.)

Using the actual consumption rates of coal by month for the 1977/78 heating season, the 90 day and 120 day required stockpile amounts have been plotted. As indicated on Figure 2, these required amounts are significantly less than the actual amount of coal expected to be on-hand using the 1977/78 consumption rates. The maximum 120-day supply is 21,400 tons, which represents the total anticipated demand from December through March. For




# COAL STORAGE

ROCK ISLAND ARSENAL

ANTICIPATED COAL CONSUMPTION BY MONTH (BASED ON 1977/78 ACTUAL USAGE)

"CONTRACTED FOR" COAL DELIVERIES

COAL ON-HAND (STOCKPILED), TONS

120 DAY STORAGE REQUIREMENT

90 DAY STORAGE REQUIREMENT



FIGURE 2

stockpile planning purposes a maximum 120-day supply of coal should amount to 22,000 tons. A maximum 90-day supply should equal approximately 17,000 tons.

Coal is currently stored in a number of separate areas, all generally south of Building 208. (See Plate 1.) The major stockpile is located immediately north of Kingsbury Avenue and south of the rail classification yard. This area is approximately 1,100 feet long and varies in width from 140 feet on the east end to approximately 60 feet on the west. Smaller additional coal piles are located south of Kingsbury Avenue and contain high-grade/low-sulphur coal for use during regional air quality emergencies.

In accordance with TM5-675, Repairs and Utilities, Solid Fuels Operations, screened bituminous coal should not be stockpiled to a height greater than 17 feet. Using this maximum height, a 3:1 sideslope for machine compaction operations and a 120-foot bottom dimension (see Figure 3), the 120 day coal supply (22,000 tons) can be accommodated within the following calculated area.

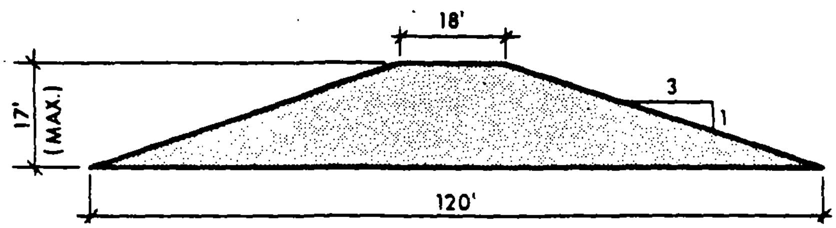



FIGURE 3

## TYPICAL CROSS-SECTION

$$2 \times \tfrac{1}{2}\ (51' \times 17') + (18' \times 17') = 1{,}173 \text{ cu.ft./lin.ft.}$$

$$\frac{1{,}173 \text{ cu.ft.} \times 60 \text{ lbs./cu.ft.}^{(2)}}{2{,}000 \text{ lbs./ton}} = 35.2 \text{ tons/lin.ft.}$$

$$\frac{22{,}000 \text{ tons}}{35.2 \text{ tons/lin.ft.}} = 625 \text{ lin.ft.}$$

(2) Weight of bituminous coal in accordance with TM5-675 is 50 lbs. per cubic foot. Sixty pcf was used in this example because of moisture content and compaction requirements.

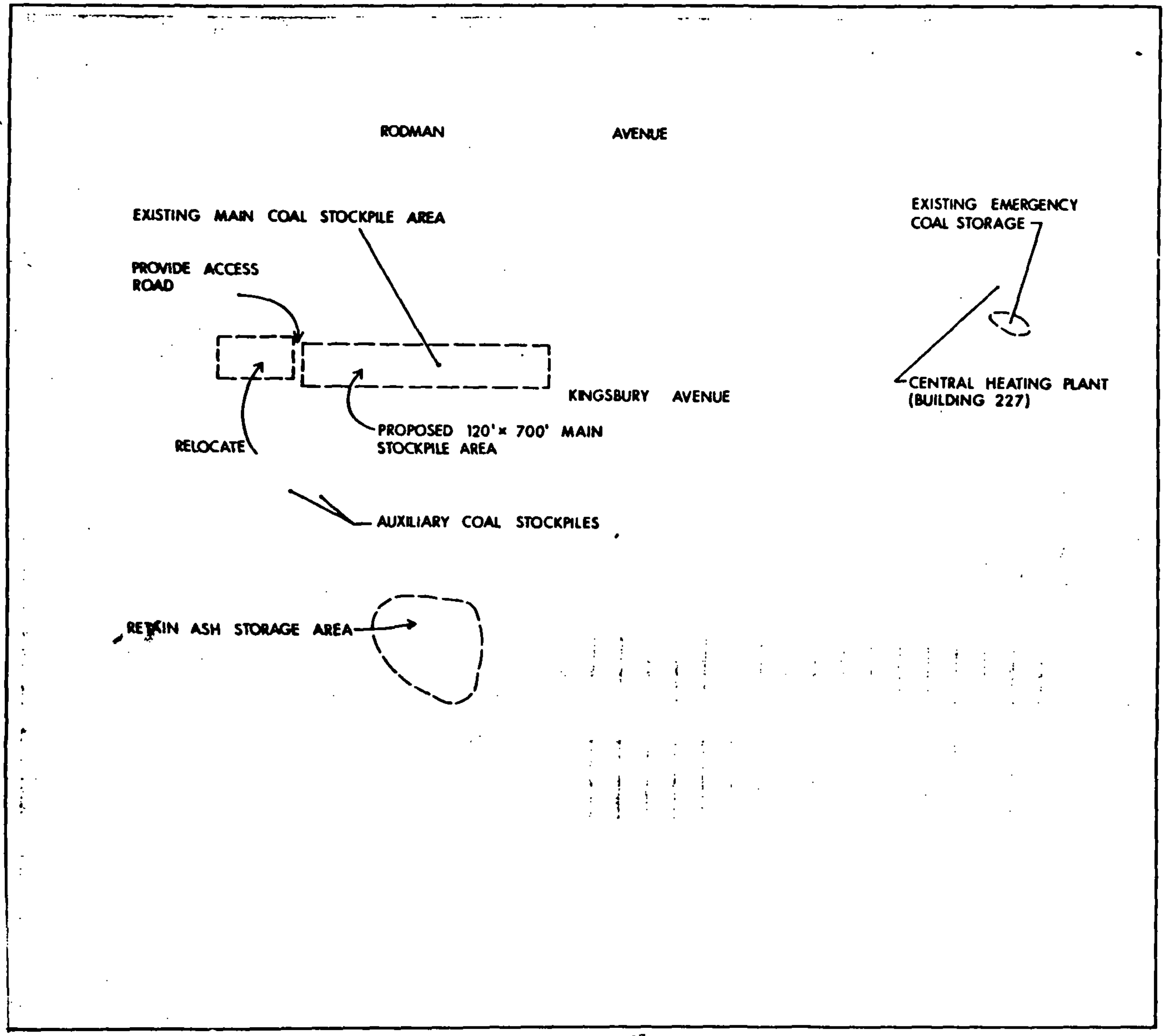
Therefore, the 120 day stockpile requirement can be accommodated within a land area measuring 120 feet wide and 625 feet long, using a maximum height of 17 feet and 3:1 sideslopes, as illustrated in Figure 3. This area is significantly smaller than the current designated stockpile area, which measures over 1,000 feet long. This area seems adequate for continuous use as a coal stockpile area, providing that consumption rates do not greatly increase above those experienced over the past few years. By reducing the height of the coal pile, the entire 1,000 foot storage length could be utilized. Table 3 illustrates the changes in stockpile lengths associated with a reduction in fill height using the same sideslopes and bottom dimensions shown in Figure 3. By using a 13-foot fill height, which is easier to compact, the entire 120 day coal stockpile can be located in an area 120 feet by 700 feet.

Table 3

Coal Stockpile Dimensions for Various Fill Heights
(22,000 tons)

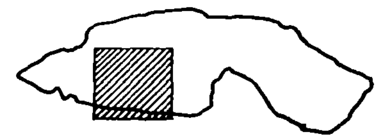
Rock Island Arsenal, Illinois

| Height (feet) | Bottom Width (feet) | Top Width (feet) | Length (feet) |
|---|---|---|---|
| 17 (max) | 120 | 18 | 625 |
| 15 | 120 | 30 | 652 |
| 13 | 120 | 42 | 696 |
| 11 | 120 | 54 | 766 |
| 9 | 120 | 66 | 876 |




# ROCK ISLAND ARSENAL
## ROCK ISLAND, ILLINOIS

## EXISTING AND RECOMMENDED COAL STOCKPILE AREAS



KEY MAP

DATE OF AERIAL PHOTOGRAPH
17 NOVEMBER 1976

GRAPHIC SCALE IN FEET
0 300 600 900

HARLAND BARTHOLOMEW AND ASSOCIATES
PLANNING ENGINEERING LANDSCAPE ARCHITECTURE
NORTHBROOK MARCH 1979 ILLINOIS



PLATE 1

Because the above requirement can be contained in an area smaller than the existing main stockpile along Kingsbury Avenue, it is recommended that the remaining coal piles to the south be relocated to the main storage area in order to facilitate handling and delivery. (See Plate 1.) Since this coal is of a superior grade, it should be segregated from the primary stockpile by an access road from Kingsbury Avenue.

## Storm Drainage

Drainage in the vicinity of the coal storage areas is principally by surface runoff with only a few minor concentration points. (See Plate 2.) Runoff from the main stockpile area is generally by sheet flow south across Kingsbury Avenue into a heavily wooded area separating the former ammuniton storage area. Some concentrated flow occurs at a point near the east end of the main coal pile. A small diameter culvert carries this drainage south across Kingsbury Avenue into a small swale. A water quality test, discussed in greater detail in subsequent portions of this report, was taken at this location. Roof drainage from the extensive building complex located immediately north of the rail classification yard and coal stockpile area is contained in an enclosed perimeter storm drainage system which continues north across Rodman Avenue and west to an outfall near Lock and Dam No. 15. Additional enclosed drainage systems are located to the west of the stockpile area principally collecting street runoff from Sylvan Drive and a portion of Kingsbury Avenue and to the east serving Buildings 220, 222, 230, and 240. The outfalls associated with these two systems discharge south to the Sylvan Slough. A field investigation in November, 1978, showed that no stockpile runoff enters any storm sewer inlets in the area.

Based on the present location of the coal stockpile and the adjacent sewer systems, the storm drainage tributary area affecting (and including) the main stockpile amounts to an estimated 6.5 acres. Using rainfall intensity/-duration figures developed previously for interior drainage and flood protection improvements at the Arsenal, this area would produce a 100-year discharge of approximately 35 cfs. As mentioned previously, most of this runoff is characterized by a sheet flow generally south across Kingsbury Avenue. It is estimated that less than 5 cfs. would be concentrated at the nearest culvert located about 100 feet east of the main stockpile, under peak flow conditions.

Non-responsive

[redacted]

## RECOMMENDATIONS

Since stockpile runoff remains highly dispersed as it leaves the area, no point sources of potentially polluting flow are generated and no NPDES permit is required. A permit would be required if the runoff were collected and discharged into a stream considered part of the "waters of the State," or if a substantial portion of the flow entered a storm sewer which discharged to "waters of the State."

The non-point nature of flow away from the stockpile area means that the chemical quality of the runoff varies greatly with storm frequency and intensity and with specific location. One grab sample was taken from a small ponding area near the southeast corner of the stockpile (see Plate 2) following a storm; analysis of the sample showed the following:

| | Sample | Illinois EPA Water Quality Standards |
|---|---|---|
| PH | 7.67 | 6.5 to 9.0 |
| Mercury | < 0.0005 mg/l | 0.0005 mg/l |
| Iron | 4.62 mg/l | 1.0 mg/l |
| Sulfate | 122.5 mg/l | 500 mg/l |

While the iron level in this particular sample was high, there does not appear to be any significant water quality hazard resulting from the runoff. Nearly all of the water together with dissolved and suspended materials are assimilated by the upper soil levels in the land area (mostly tree-covered) directly south of the stockpile area. No further testing is recommended because there are no controlling criteria to be met. This view has been corroborated in conversations with Illinois EPA (Mr. John Anderson, Division Manager, Division of Mine Reclamation, Ill. EPA, Springfield, Ill.).

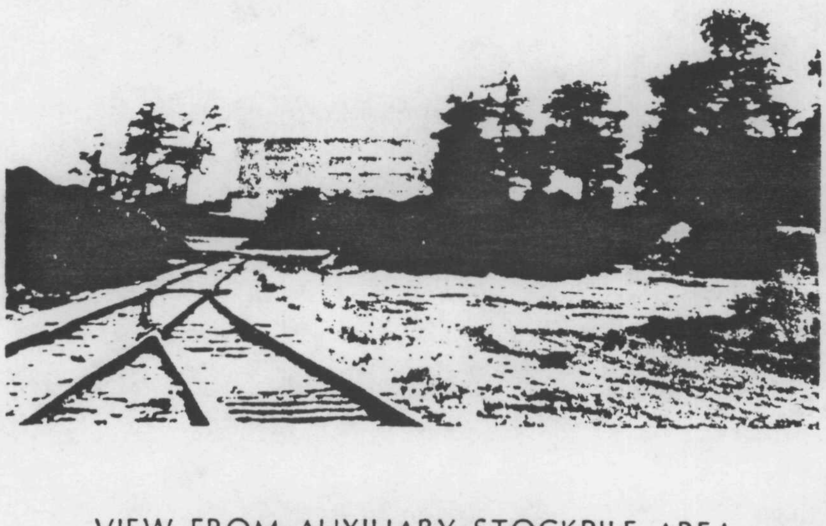
No future problems are anticipated as a result of coal pile runoff, provided that land area south of the stockpile is not changed in ways which would decrease its ability to assimilate the dispersed runoff. The very gentle slope, the vegetation and the naturally rough surface are the key features responsible for the assimilation. The importance of maintaining this area in its natural state should be emphasized by a note on the installation Future Development Plans.

Because the 120-day minimum coal stockpile requirement can be contained in an area smaller than the existing main stockpile along Kingsbury Avenue, it is recommended that the small auxilliary coal piles located immediately south be relocated to the main stockpile area to facilitate handling operations and to eliminate other possible sources of concentrated runoff. Since this coal is of a superior grade, it should be segregated from the main stockpile by an access road from Kingsbury Avenue.

## APPENDIX A

## PHOTOGRAPHS


VIEW FROM MAIN STORAGE AREA TO
SOUTHEAST SHOWING LOCATION OF
AUXILIARY (HIGH-GRADE) COAL STOCKPILES



VIEW FROM AUXILIARY STOCKPILE AREA
NORTHWEST TO BUILDING 208

APPENDIX L

Sanitary Landfill

Project No. D-209-W

# WATER POLLUTION STUDY
for
# ROCK ISLAND ARSENAL

Rock Island, Illinois

PROJECT NO. D-209-W
SANITARY LANDFILL

Prepared Under the Direction of
DEPARTMENT OF THE ARMY
Omaha District, Corps of Engineers
Omaha, Nebraska

Prepared by
Harland Bartholomew and Associates
Northbrook, Illinois

Contract No. DACA 45-76-C-0157
Modification No. P00003

23 March 1979

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# INTRODUCTION

In recent years, the Department of the Army, as well as other Federal agencies, has accelerated its efforts to comply with established pollution control standards at all its facilities. A Presidential Executive Order (No. 12088) signed on October 13, 1978, required that all necessary actions be taken for the prevention, control and abatement of environmental pollution at facilities under the control of each Executive agency. Prior to this Executive Order, the Department of the Army completed a comprehensive Pollution Abatement Survey at a total of 129 installations including the Rock Island Arsenal. The purpose of this survey was to identify all potential pollution sources not previously recorded and for which no corrective actions or plans had been formulated. One of these possible sources at the Rock Island Arsenal included potential seepage of pollutants from a former landfill site located near the Sylvan Slough. (See Plate 1.)

The purpose of this study is to extend the preliminary findings of the previous identification survey by evaluating the seriousness of the possible pollution source and to recommend corrective measures if violations of applicable regulations are found. The results of this study, together with cost estimates developed for possible corrective actions will be suitable for the preparation of a Project Development Brochure and a DD Form 1391 for future construction programming purposes if required.

Non-responsive

[redacted]

# EXISTING CONDITIONS

## General

A sanitary landfill, located at the south end of the island, has periodically been used for the disposal of various items but has been inactive for approximately 15 years. According to Facilities Engineering personnel, this site, approximately 1,800 feet long and between 150 and 200 feet wide, has been used for the disposal of construction-related material (rubble, concrete, timber, etc.) and various surplus metal from adjoining manufacturing and storage areas. (See Plate 1.) A site inspection conducted in October, 1978, revealed the presence of oily deposits in two locations immediately south of Gillespie Avenue. These wastes, plus the location of the landfill site in close proximity to the Sylvan Slough, were instrumental in the determination of this former facility as a potential water pollution source.

## Testing

In order to investigate whether or not polluting leachate is moving to Sylvan Slough from the landfill, five wells were drilled to bedrock near the southern perimeter of the landfill. (See Plate 1.) These wells show depth to bedrock and can be used as groundwater sampling points. It was assumed that potentially leachable materials would have been relatively well dispersed in the landfill volume, particularly in the direction of bedrock slope.

Well borings showed that depth to bedrock ranges from 11' 6" to 24' 2" near the southern perimeter of the landfill. This would place bedrock at elevations of between 529' and 546' above mean sea level, with a significant slope in a southwesterly direction. Leachable materials moving to bedrock would tend, therefore, to move toward the slough in a southwesterly direction.

Groundwater was encountered at roughly 8' to 12' below the surface. However, since the landfill site is periodically flooded (Preliminary Design Analysis Line Item 52, Flood Protection, Rock Island Arsenal, prepared by U.S. Army Engineer district, Omaha, May, 1972), groundwater levels rise periodically to and above ground elevation. This means that most of the landfill materials have been heavily leached over the years since the landfill was started. It is reasonable to conclude that leach rates will not increase in the future — they may have been higher at various times in the past.

Material near the surface at well locations included cinders, pieces of concrete, limestone boulders, wood, metal, and some moist, gray, soft clay. Materials below the surface consisted of clay, sand, and some gravel. (Drilling information is provided in Appendix A.)

In each well a four-inch PVC pipe was inserted to the level of bedrock. One month after the wells were drilled, water samples were taken from three wells and tested for a range of potential contaminants. Test results are shown in Table 1. All water quality analyses were performed in accordance with "Standard Methods for the Examination of Water and Wastewater," 14th Edition, 1975. In no case does water quality violate State standards.

Materials removed from the well during drilling were tested for leachate quality. These sample materials were collected at the time of drilling (October 24-25, 1978) and tested one month later. Leachate test results are shown in Table 2. The testing method followed the standard Illinois EPA "pH 5 Extraction Procedure" as supplied by Illinois EPA in November, 1978.

Leachate test results show that significant amounts of oil are retained by the landfill materials. Samples of 100 grams (dry weight of unleached material) yielded up to 0.043 grams of oil under the leachate test conditions, consisting of 750 ml. of continuously stirred deionzed water at pH 5 for 24 hours. Water in the test wells, however, shows that leaching under existing conditions in the landfill is now proceeding at a much lower rate. (See Table 1.) Groundwater contains less than one-third the effluent standard. Based on these results, the probability of significant oil movement from the landfill to Sylvan Slough is very small.

One leachate test sample (Table 2, test well no. 3) showed elevated levels of iron. All samples showed slightly elevated levels of zinc and nickel. As in the case of oil, levels of these metals do not violate State standards in any of the test well water samples. Again, based on these results, the probability of significant movement of heavy metals to Sylvan Slough is very small.

A military construction project is currently programmed to construct a combination of levees and floodwalls to protect the Arsenal from floods having a discharge of 385,000 cubic feet per second and a design occurrence of 200 years. This flood would produce a water surface elevation of 568.7 feet at the Lock and Dam No. 15 tailwater gauge. Because of the scope of the project, the improvements are planned in two separate phases. The first phase consists of the construction of floodwalls and levees along scattered portions of the north and east sides of the island. The second phase of the flood protection project would begin at the Moline Bridge and extend downstream along the Sylvan Slough to a point southeast of the Naval and Marine Corps Reserve Training Center. A portion of this phase of the improvements will consist of an earth embankment constructed on top of the abandoned landfill areas. The top crown of the levee in this area will be constructed to an elevation of 572.0 feet which will provide a three-foot freeboard to the design water surface elevation of 569.0 feet. At this design flood occurrence, water will be approximately nine feet above the existing ground elevation in the vicinity of the landfill. Under these conditions, hydrostatic pressure will tend to reverse the normal flow of groundwater toward the inside of the embankment. Because of extensive provisions along

Table 1

WATER QUALITY IN THREE TEST WELLS

Sanitary Landfill, Rock Island Arsenal

(all units mg/l except pH)

| | Test Well No. 1 | Test Well No. 2 | Test Well No. 3 | Illinois EPA Water Quality Standards |
|---|---|---|---|---|
| pH | 7.17 | 7.42 | 6.83 | 6.5-9.0 |
| oil | 3.7 | 2.8 | 3.5 | (15)* |
| mercury | <0.005 | <0.005 | <0.005 | 0.0005 |
| zinc | 0.012 | 0.002 | 0.005 | 1.0 |
| cyanide | <0.001 | <0.001 | <0.001 | 0.025 |
| chromium (Cr+3) | <0.005 | <0.005 | <0.005 | 1.0 |
| chromium (Cr+6) | <0.005 | <0.005 | <0.005 | 0.05 |
| nickel | <0.01 | <0.01 | <0.01 | 1.0 |
| copper | 0.015 | 0.007 | 0.001 | 0.02 |
| iron | 0.21 | 0.38 | 0.35 | 1.0 |
| cadmium | <0.001 | <0.001 | <0.001 | 0.05 |

*Illinois EPA effluent standard.

Table 2

WATER QUALITY OF SOLUBLE PORTION
OBTAINED WITH LEACHATE TEST

Sanitary Landfill, Rock Island Arsenal

(all units in ppm except pH)

| | Test Hole No. 1 (9' to 10'6") | Test Hole No. 2 (15' to 16'6") | Test Hole No. 3 (20' to 21'6") | Illinois EPA Water Quality Standards |
|---|---|---|---|---|
| pH | 7.01 | 8.62 | 7.97 | 6.5-9.0 |
| oil | 250 | 140 | 430 | (15)** |
| phenol | <0.01 | 0.02 | <0.01 | 0.1 |
| mercury | <0.005 * | <0.005 * | <0.005 * | 0.0005 |
| zinc | 0.56 | 0.40 | 0.90 | 1.0 |
| cyanide | <0.05 | <0.05 | <0.05 | 0.025 |
| chromium (Cr+3) | <0.05 | <0.05 | <0.05 | 1.0 |
| chromium (Cr+6) | <0.05 | <0.05 | <0.05 | 0.05 |
| nickel | 0.5 | 0.3 | 0.1 | 1.0 |
| copper | <0.01 | 0.01 | <0.01 | 0.02 |
| iron | 0.3 | 0.3 | 4.5 | 1.0 |
| cadmium | 0.04 | 0.002 | 0.01 | 0.05 |

*Due to Illinois EPA procedure of diluting samples by a factor of 10, these data cannot be measured to the level of significance required.

**Illinois EPA effluent standard.

of the flood protection improvements to control underseepage and remove interior drainage, this movement of groundwater will not constitute a significant hazard.

## CONCLUSIONS

We therefore recommend no corrective measures in connection with the landfill site. We do recommend, however, that periodic inspections be made of the present landfill surface to ensure that effective surface drainage is maintained throughout. Excessive ponding at the surface could lead to increases in leach rates locally and could increase delivery of oil and/or heavy metals to the Sylvan Slough.

The Illinois EPA, Division of Land Pollution Control, enforces regulations controlling landfills under its jurisdiction. When a landfill is closed, the Illinois EPA - DLPC requests the implementation of certain procedures to insure against potential leachate problems. Depending on the results of on-site inspections, the DLPC normally requests that a compacted (.90-95 percent Proctor) clay cap be placed over the entire landfill, usually two feet thick. The owner must then monitor the landfill for three years, filling areas of subsidence and correcting any ponding problem that may occur.

In cases of landfills that have not been recently active, the usefulness of such a clay cap is questionable. Since the groundwater is typically ten feet below grade, any leachable material has had ample opportunity in the past 15 years to escape the site. To resolve all doubts, a copy of this report illustrating the subsurface sediments and the associated contaminant levels, could be sent to Terry Ayers, Illinois EPA, Division of Land Pollution Control, Land Permits Section, 220 Churchill Road, Springfield, Illinois 62706, requesting that the Agency determine the need for an on-site inspection and/or the need for leachate prevention procedures to be undertaken.